SCIENTIFIC AMERICAN

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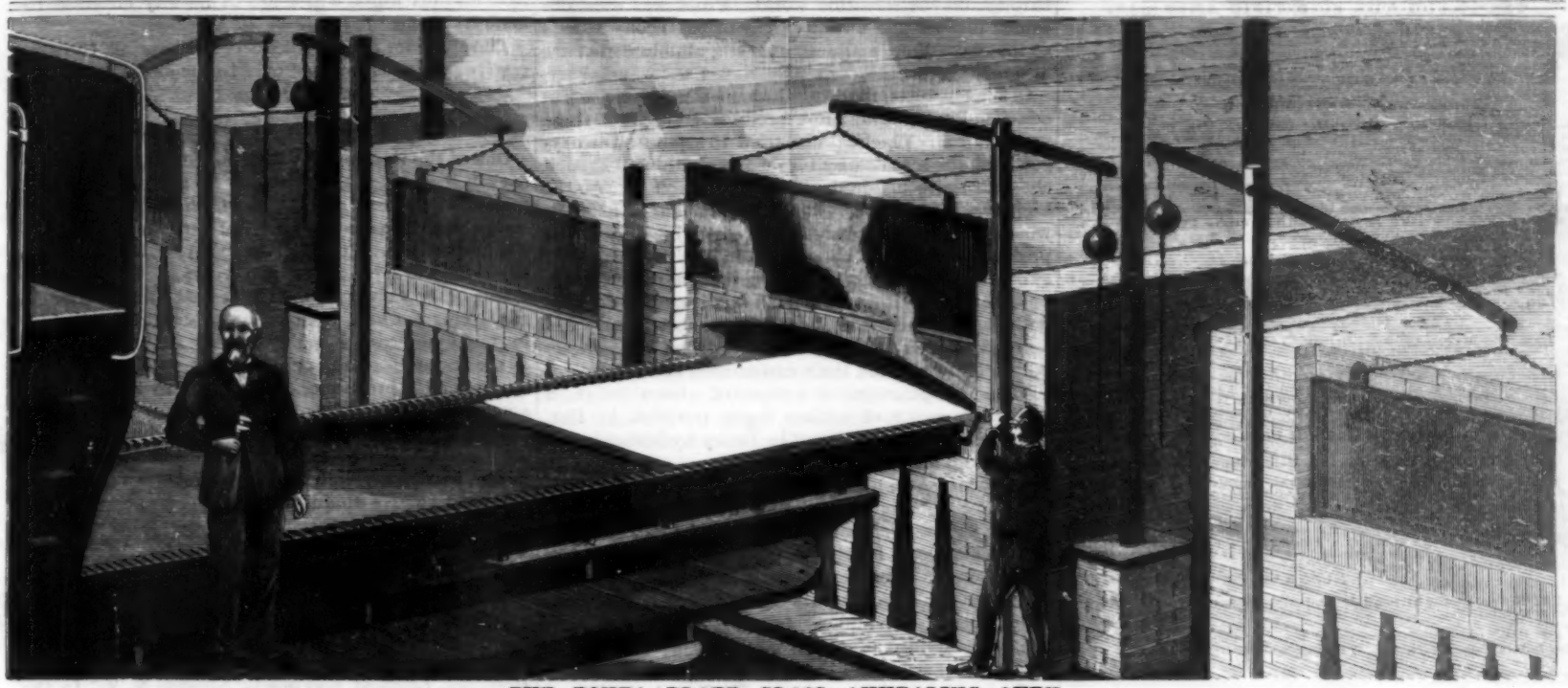
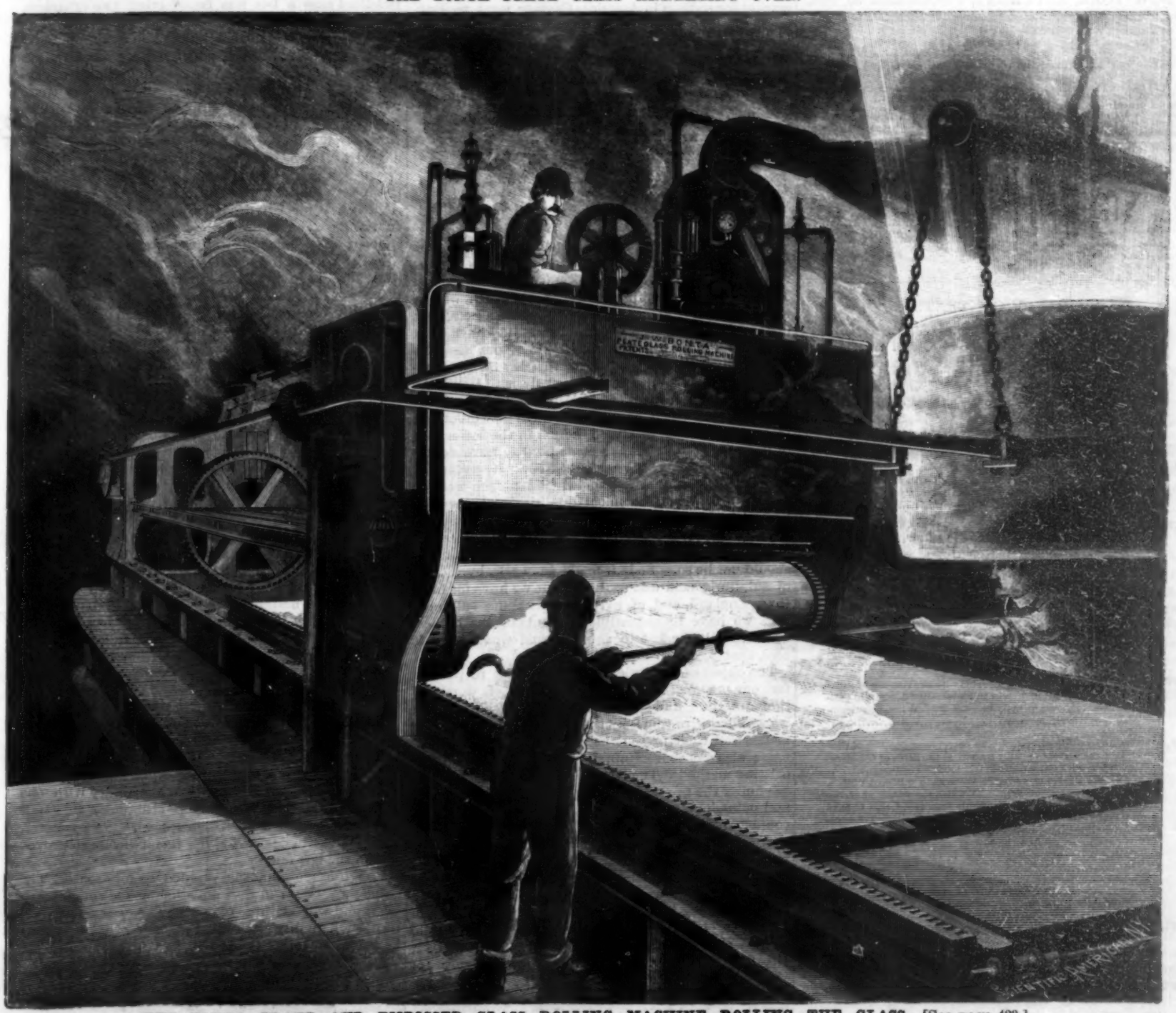
A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LXIX.—No. 27. ESTABLISHED 1845. NEW YORK, DECEMBER 30, 1893. $3.00 A YEAR. WEEKLY.



THE BONTA PLATE GLASS ANNEALING OVEN.



THE BONTA PLATE AND EMBOSSED GLASS ROLLING MACHINE—ROLLING THE GLASS.—[See page 423.]

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

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One copy, one year, for the U. S., Canada or Mexico.....$3 00
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One copy, one year, to any foreign country belonging to Postal Union. 4 00
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MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

The Scientific American Supplement

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NEW YORK, SATURDAY, DECEMBER 30, 1893.

Contents.

(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 939.

For the Week Ending December 30, 1893.

Price 10 cents. For sale by all newsdealers

THE ALKALI METALS, POTASSIUM AND SODIUM.

Sir Humphry Davy obtained in 1807 from potash, by the action of a voltaic battery of the greatest power which had then been constructed since its discovery in 1800, a brilliant, bluish metal, lighter than water and so soft that it could be welded between the fingers at ordinary temperature, as iron is at high heats by blows of a hammer. He extended his experiments to soda, and found a similar weldable metal, also lighter than water, silvery white in color. That potash and soda were oxides had been suspected by chemists, and this confirmation of the view created great excitement throughout the scientific world. Proof was soon obtained further that all the earthy or basic constituents of the rocks, lime, magnesia, baryta, alumina, etc., are also oxides of metals.

Other chemists, realizing that the electrolytic methods then known could not produce enough of these metals for any practical use, tried to separate the oxygen from the alkalies by furnace operations. French chemists succeeded in decomposing potash by *iron* at high heat, but they obtained a *liquid* metal at first, which was subsequently discovered to be due to the presence of soda as an impurity in their potash—the two alkali metals forming together a permanently liquid alloy. With *pure* potash and iron Davy's solid potassium was obtained, and it was subsequently discovered that at very high heats carbon decomposes potash and soda and their carbonates, the metals distilling over—potassium as a vapor of a beautiful green color, the vapor of sodium being purplish in tint. These vapors are condensed in heavy hydrocarbon oil or melted paraffine wax.

In recent years, by reason of the belief, now general, that the clay-metal aluminum is destined to rank in usefulness with iron and steel, and of the fact that aluminum has been heretofore obtained by the action of sodium on aluminum compounds, an American chemist (Castner) made new efforts to obtain sodium cheaply. He combined iron and carbon, producing a peculiarly intimate mixture of the two. This operates on the carbonate of soda to great advantage, more rapidly and at a lower temperature. Finding but a small market for sodium in America, Castner went to England, and influenced capital to build large works for carrying out his new inventions, which were numerous, and extended to the manufacture of aluminum, as will be set forth in another article. As a result largely of the work of Castner, the following quotations for sodium, in this country, may be cited:

May 12, 1888	$4.50 per lb.
May 25, 1889	2.75 " "
Oct. 26, 1889	2.50 " "
May 30, 1891	2.50 " "
Sept. 24, 1890	50 to 75 cts. " "
April 25, 1893	50 to 75 cts. " "
Aug. 19, 1893	$1.75 " "

The latter figure is quoted at the present date. The only reasonable explanation of the sudden rise in the valuation of sodium during 1893 is that it has passed out of use for the making of aluminum, which was its main channel of consumption. The electrolytic methods—such as Davy first introduced—have come back again; and with the potent aid of our magnificent dynamo-electric machinery, the clay-metal is produced much more cheaply by electrolysis. Hence the twenty sodium furnaces of Castner, at Oldbury, near Birmingham, which, according to an article before us, from *Engineering*, produced sodium in the latter part of 1888 at a cost of about 18 cents per lb., have doubtless gone out of use to a great extent. Nevertheless, the fact remains that sodium, which has such wonderful and exceptional chemical qualities and energies, was made for less than the cost of tin. With us, the cost would be a little higher, probably; for, as yet, most of our soda is imported from England. But this should not be so. Soda is made from salt, by the aid of sulphuric acid and coal. Of salt we have far more than England, and of pyrites for making sulphuric acid we have inexhaustible amounts of the highest grades, while she has to ship it from Spain. As to coal, that "goes without saying."

The object of this series of articles being to put before our practical men and inventors objects worthy of their ambition, and suggestions how to realize these, we will first give concisely the qualities of these alkali metals and their present uses, and then suggest new uses; also methods of obtaining them independent of existing methods. The latter, it is only safe to assume, are under the protection of existing patents. Sodium and potassium, and their liquid alloys, all take fire on contact with water, and burn with great violence and energy, and with enormous heat. They must all be preserved under the surface of hydrocarbon oils. A good article of common kerosene will answer. The solid metal ingots are easily divided under the oil with a knife, cutting like hard wax. The liquid alloys, of course, can be poured. Some density figures for solid sodium and potassium were given in SUPPLEMENT, No. 988, December 23, 1893. The mean figure for sodium is about 0·97 (water = 1). The mean for potassium about 0·875. Sodium, when melted at about 208° F., is about 0·929, and at its boiling point (900° F.) 0·744. The liquid alloy is about 0·891. The latter has about four times the coefficient of expansibility of mercury, and of late thermometers have been made with it in England, in an experimental way. These give indications far higher than mercurial thermometers, and the degrees are four times as long. Such thermometers will probably be unsafe for ordinary usage, but invaluable as instruments of scientific research. All these substances when placed suddenly under water explode with enormous energy. They amalgamate with mercury, but with violent explosion. Davy found that such amalgams would coat over iron, steel and platinum, which are in no way enfilmed by mercury alone.

The space for this article being exhausted, the *suggestive* portion is crowded over to the next issue.

THE EXPLOSION OF HIGH PRESSURE GAS CYLINDERS.

One of the interesting developments of technical science is the commercial supply of gases under high pressure. Oxygen and hydrocarbon gases are now compressed into steel cylinders of very small size, relatively speaking. The gas is reduced to less than one one-hundredth of its normal volume. Another example of the same system is furnished by carbonic acid gas. This can be bought in the liquid state, contained in steel cylinders. Faraday's great achievement, one of the triumphs of a life of scientific experiment, is now a commercial process, and is applied to the supply of an everyday commodity.

Oxygen and hydrogen gases will stand unlimited pressures without liquefying. There is a special temptation to employ high pressures in their case, as the volume regularly diminishes as compression is applied. It is customary now to sell the cylinders filled at nearly 1,800 pounds pressure to the square inch. An innocent looking cylinder, less than five feet long and a few inches in diameter, may have locked up within it nearly a thousand tons of total pressure. If such a cylinder gives way, a dreadful explosion will ensue.

Two such accidents have recently occurred, one in Bradford, England, and one in Albany, N. Y. In the Bradford case a boy was transferring two cylinders, dragging one behind him and carrying the other. The dragged cylinder exploded, killing him on the spot and injuring a man. The Albany explosion occurred on December 6, on a dock. A number of cylinders of oxygen and of hydrocarbon gas, called in the trade "hydrogen," were being shipped from New York to Albany. All but one had been taken from the dock where they had been placed. On attempting to remove this it exploded. It is believed that it was thrown down by the man carrying it. One man was fatally injured, two others were hurt, one seriously and one slightly. It was a hydrogen cylinder which exploded. In both cases the pressure of the gas was 120 atmospheres, or 1,800 pounds to the square inch.

In the London *Engineering* of December 8, 1893, a letter has been published emanating from the developer of the process used in making the cylinders originally used for high pressure oxygen gas. He describes his process of pressing the cylinders up from disks of sheet steel of approved quality. At a certain stage of the process a bursting strain of two tons per square inch is applied to detect hidden defects; when finished and annealed, a final test of one and one half tons is given them. The *rationale* of the two tests he does not explain. Such cylinders the writer in question, Mr. Howard Lane, says are worked by the German government up to 160 atmospheres or 2,400 pounds to the square inch. The regular pressure used here and in England is 120 atmospheres, or 1,800 pounds per square inch.

The governments of different countries take cognizance of steam boilers and see that they are tested at proper intervals. No boiler can be legally used without proper permit or license. It would be well both for the public and for the dealers in high pressure gases to subject these gas cylinders to proper tests and examination. It should include the fullest possible tests of the quality of the metal, even if it involved the cutting up of an occasional cylinder. Mr. Howard Lane in the communication referred to claims that the cylinder which exploded at Bradford was made by an opposition company, and was not of suitable material. Not only strength, but ductility of the steel is an important element of safety. If a boiler with perhaps only fifteen pounds pressure per square inch is an object of governmental regulation, a cylinder with one hundred times that pressure is still more so. It is nothing less than a shell charged with an explosive, whose power in destroying life has twice been proved within the last few weeks.

Rough usage cannot be pleaded as an excuse. The shippers of goods always have employed rough treatment and will continue to do so. The cylinders should be of such quality as to stand anything that they may be subjected to.

THE Hoosac tunnel, Massachusetts, is the longest in the United States; length, four and three-fourths mile; cost, $14,000,000.

[FROM ASTRONOMY AND ASTRO-PHYSICS.]

The Planets for January.

Mercury having been at greatest western elongation December 14, will in January be too close to the sun for observation. He will be at superior conjunction January 29, at 6 h. 36 m. A. M.

Venus, which has been such a brilliant object in the early evening sky during the past month, will be still more brilliant during the first part of January. This planet will attain its maximum brilliancy on January 10, when the light will be 218, as compared with 145 on December 1. The position of Venus is becoming a little more favorable for observation in northern latitudes, as the planet moves northward in declination. Venus and the crescent moon will be in conjunction on the morning of January 10, and the two will form a pretty pair on that evening and the preceding.

Mars will be morning planet during January, visible in the southeast after 5 o'clock. The low altitude will prevent good observations in our latitude, but south of the equator something may be done in the study of the surface markings of the planet. Mars and the waning moon will be in conjunction on the morning of January 3, the latter passing 4° south of the former.

Jupiter will be in excellent position for observation during the first half of the night in January. The planet will be stationary among the stars of Taurus on January 15, after which it will move slowly eastward. The "great red spot" was well seen by us with the 16 inch telescope on the night of October 31. Its center was on the central meridian of Jupiter at 11 h. 31 m., Central time, as near as we could estimate. This time agrees closely with that predicted by Mr. Marth. The spot was seen without difficulty, although the color was quite faint. The color was exactly the same as that of the belt just to the south of it, and the two objects merged into one another without the slightest change in intensity of color. The outline of the spot seems to be the same as in past years, except as stated above, that its southern edge is merged into the belt. There seemed to be two white clouds over the central portions of the spot, the following of the two being the larger. The seeing was excellent during this observation and much of very minute detail was seen in all the belts.

Saturn is getting into better position for observation in the morning, but the majority of observers will prefer to wait two or three months until the planet is visible in the evening. Saturn will be at quadrature, 90° west from the sun, January 14. Saturn is in the constellation Virgo, a little northeast of Spica, and is moving very slowly eastward. The moon will be 4° south of Saturn at noon, January 27.

Uranus is in the constellation Libra, a little way east of the star α. It is not yet in very good condition for observation in our latitude.

Neptune, having passed opposition in December, will be in excellent position for observation in January. It will move very slowly westward during the month, the position January 1 being a little more than one-third of the distance on a straight line from ι to ε Tauri. There is no star of equal brightness within a radius of 1°.

November Meteors.—The November meteors were far more abundant this year than I have ever seen them before. Especially were they plentiful on the mornings of November 13, 14, and 15. Many very brilliant ones were seen. One on the morning of the 14th burst just below Coma Berenices It was nearly as large as the full moon. On November 15, at 14 h. 50 m., a splendid meteor from Leo shot across the sky and burst between Zeta and Eta Ursæ Majoris. This left a persistent train about 10° long, which remained bright and straight for about five minutes, like a slender comet; it then collected into a cloudy mass at the point of explosion. This elongated mass of luminosity remained distinctly visible for half an hour, drifting due east in the meantime about 7°. As I was photographing the comet at this time I could not turn my telescope to it to see how long it remained visible after it had ceased to be seen with the naked eye. E. E. BARNARD.

Mt. Hamilton, November 19, 1893.

George A. Hill, United States Naval Observatory, Washington, D. C., has been appointed to the position of assistant astronomer in the observatory. He is now at work with the Prime vertical transit instrument. He takes the place of A. Hall, Jr., who resigned not long ago to accept the position of director of the Detroit Observatory at Ann Arbor, Michigan.

Professor S. W. Burnham.—At a recent meeting of the board of trustees of the University of Chicago, Mr. S. W. Burnham was unanimously elected professor of practical astronomy. The department of astronomy is to be congratulated on securing Professor Burnham's eminent services, and the honor which the university authorities have thus done to the cause of science will be fully appreciated by astronomers everywhere, who will rejoice to learn that Professor Burnham will again have adequate opportunities for continuing his splendid investigations in double star astronomy. It is understood that the micrometrical measurement of double stars is one of the principal lines of research contemplated with the great 40 inch refractor of the Yerkes Observatory.

Stephen Wilcox and George H. Babcock.

On November 27, Stephen Wilcox, one of the founders of the Babcock & Wilcox Company, the well-known engineers and boiler manufacturers, died at his home in Brooklyn, N. Y., after a brief attack of pneumonia. It was said of him that he had a simple, genial nature, which would know nothing but the right, whatever the interests involved, besides rare mechanical ability. He was born at Westerly, R. I., about sixty-three years ago.

Within a few days following, on December 16, at Plainfield, N. J., occurred the death of the other of the principal members of this firm, Mr. George H. Babcock, in the 61st year of his age. He was among the first to invent a press for chromatic printing, and during the war invented a shrapnel shell.

Mr. Babcock had been married four times. Last summer he married Miss Eugenia Lewis, a teacher in the Plainfield public schools. He had been president of the Plainfield Board of Education since 1885. He was a lecturer in the mechanical engineering course at Cornell University, and a member of the New York and Plainfield Camera clubs. Some of his lectures in the engineering course at Cornell have been published in the SCIENTIFIC AMERICAN SUPPLEMENT. He was an art critic, and his home is filled with choice works. Several of his collections were exhibited at the World's Fair. He leaves one child, a boy eight years old.

The Social Condition of Workingmen.*

BY RALPH D. ST. JOHN.

The "Seventh Annual Report of the Bureau of Labor," at Washington, has been recently published. The report relates to the cost of producing textiles and glass in the United States and in Europe; to the wages paid to the persons employed in these industries; and to the cost of living of the laborers. My object is to draw from the tables in the report some inferences as to the real condition of American laborers, and as to the relation existing between their condition and the cost of living. The following details are taken from the cotton, the woolen, and the glass industries.

It is found that in the cotton industry, of the 2,132 families considered, 168 owned their house. The average size of the family was 5·7 persons. The average total yearly income for each individual was $114.70, the expenditure $106.48. Of the whole number of families, 765 came out at the end of the year with a deficit, which amounted on an average for each to $54.16. Averaging the total surplus among the 1,151 families who had accumulated, it gave as the share of each $123.33. The average expenditure for food was $287.06 a family, or $50.06 an individual. The total cost of living, other than for food and rent, was $258.79 a family, or $45.13 an individual.

In the woolen industry, 911 families were considered, of whom 154 owned their house. Average size of family, 4·9 persons. For each individual, the average total income was $136.49; the average expenditure $122.28. A deficit was traced to 208 families, of the average amount of $61.49; and a surplus of $136.16 to each of 583 families. The cost of food was $362.85 a family, $54.10 an individual. Total expense, other than for food and rent, was $256.32 a family, $52.76 an individual.

In the glass industry, of the 1,276 families visited, 339 owned their home. Average number of persons in each family, 4·8. For each person the average income was $177.81, the average expenditure $159.07. An average deficit of $92.59 was traced to each of 453 families; 766 families had each an average surplus of $205.65. Cost of food was $294.75 a family, $60.97 an individual. Besides cost of food and rent, the expenditure was $394.37 a family, $81.57 an individual.

These figures show that, so far as financial considerations go, the three industries, in the order given, form an ascending scale. They also show that, as far as actual financial results are concerned, they all compare favorably with the general estimate which any observing person would make of the condition of the majority of people in any calling throughout the country.

I will pass now to more specific cases, with the object of seeking out the causes of the sufferings of which some working people complain. I shall trace out some of the statements concerning certain individuals and compare and contrast them.

Of two families living in Alabama, and connected with the cotton industry, it is learned that both are of American birth. Of the one designated in the tables as No. 9, the husband, aged forty-seven years, is a section hand; the wife and three children are all at work. The husband's income is $257.58, the wife's $15.63, the children's $333.56; total income, $606.77. They do not own their house. For their food, the itemized bill amounts to $261.60. For expenditure other than for food $39 goes for rent; $28 for fuel; $6 for lighting; for clothing for the husband $5, for the wife $5, for the children $45; furniture and utensils $43. The total expenditure is $562.45. Under the table of notes, in which running comments on the condition of each family are made, it is said: "They live in squalor."

In the other family, No. 35 in the tables, the husband, aged forty-six, is a carder, receiving $257. The wife stays at home, but takes boarders and lodgers, earning thus $236; the only child, a son, earns by work $120. Their itemized expenditures for food reach the amount of $279. The rent is $24, fuel $32, lighting $15; clothing for husband $12, for wife $15, son $5; furniture and utensils, $1.50. The total expenditure is $443; the surplus is $170. Their cabin is described as neat but crowded, and they have a garden.

The difference in the circumstances, under conditions quite similar, shows that the latter family have at least one of the secrets of the capitalist's success, while the other swells the list of the most miserable people in the land.

In two families of Irish nationality, living in Illinois and working in the glass industry, greater differences still are found. In one case, the husband, aged forty-two years, is a mixer; the wife remains at home; three children are at work, two at school, and two at home. The husband receives $349, the children at work $317—total income $666. Total expenditure for food, $187.40; other than food, $278.65. In the latter amount are comprised the following: Taxes, $11.50; insurance on property, $1.50, on life, $14; for religion, $1; for charity, $1.50; books and newspapers, $6.70; amusements and vacations, $10; intoxicating liquor, $26; tobacco, $5.20. Their surplus is $200, and they own their house and garden, a sewing machine, and a cow.

In the second family, the husband, aged thirty-three years, is a blower, and receives $1,449.52. The wife and three children are not wage earners. The amount spent for food is $352, other than for food, $1,097.52. In the latter sum are included: Rent, $120; labor organizations, $34.18; religion, $2; charity, $15; books and newspapers, $6.50; amusements and vacations, $30; intoxicating liquors, $400; tobacco, $52; sickness and death, $27; other expenses, $60. Total expenditures reach $1,449.52, just balancing income. One other item needs to be mentioned. In the former family the bill for clothing ran, for the husband $20, the wife $15, children $50; in the latter family, husband $125, wife $40, children $65. The remarks in the report concerning the second family are: "Wretched people, miserable home."

In this comparison the earmarks indicate a selfish, drunken husband, as the cause of the misery of the second family. It is a pity that any account of liquor entered into the first report, but it is the aim of this article to take in all particulars, average instead of extreme cases, which makes it necessary to note many things to be deplored.

The tables in the seventh, as well as in the sixth report, show that the misery often to be found existing among the working people cannot be attributed to the cost of living, or rather to the disproportion between their earnings and the cost of living. The majority of those who are classed among the destitute are to be found, it is true, among those receiving the smallest wages; but that this does not necessarily follow is proved by the fact that some of the poorest paid laborers are recorded as living in good circumstances, and as having accumulated quite a property, while others receiving the best pay are in the most miserable condition.

Thus we come by this new route to the old lesson, that the cause for the misery or the happiness of men lies within themselves and not in outward circumstances.

* Condensed for the *Literary Digest* from a paper in the *Chautauquan*, Meadville, Pa., December.

Staff in the Alhambra.

There is a general impression that staff, the material so abundantly used for the rich-looking architectural works of the great Exposition, is of French origin. But it appears to have been introduced into Europe by the Arabian Moors, and much beautiful work composed of this or kindred material is still extant in Spain. Some of the finest examples are to be found in that grand historic old Moorish fortress the Alhambra, at Granada, which was finished and decorated about the year 1348. Washington Irving, in a note in his delightful volume "The Alhambra," says:

"To an unpracticed eye the light relievos and fanciful arabesques which cover the walls of the Alhambra appear to have been sculptured by the hand, with a minute and patient labor, an inexhaustible variety of detail, yet a general uniformity and harmony of design truly astonishing; and this may especially be said of the vaults and cupolas, which are wrought like honeycombs or frost work, with stalactites and pendants, which confound the beholder with the seeming intricacy of their patterns. The astonishment ceases, however, when it is discovered that this is all stucco work; plates of plaster of Paris, cast in moulds and skillfully joined so as to form patterns of every size and form. This mode of diapering walls with arabesques and stuccoing the vaults with grotto work was invented in Damascus, but highly improved by the Moors in Morocco, to whom Saracenic architecture owes its most graceful and fanciful details."

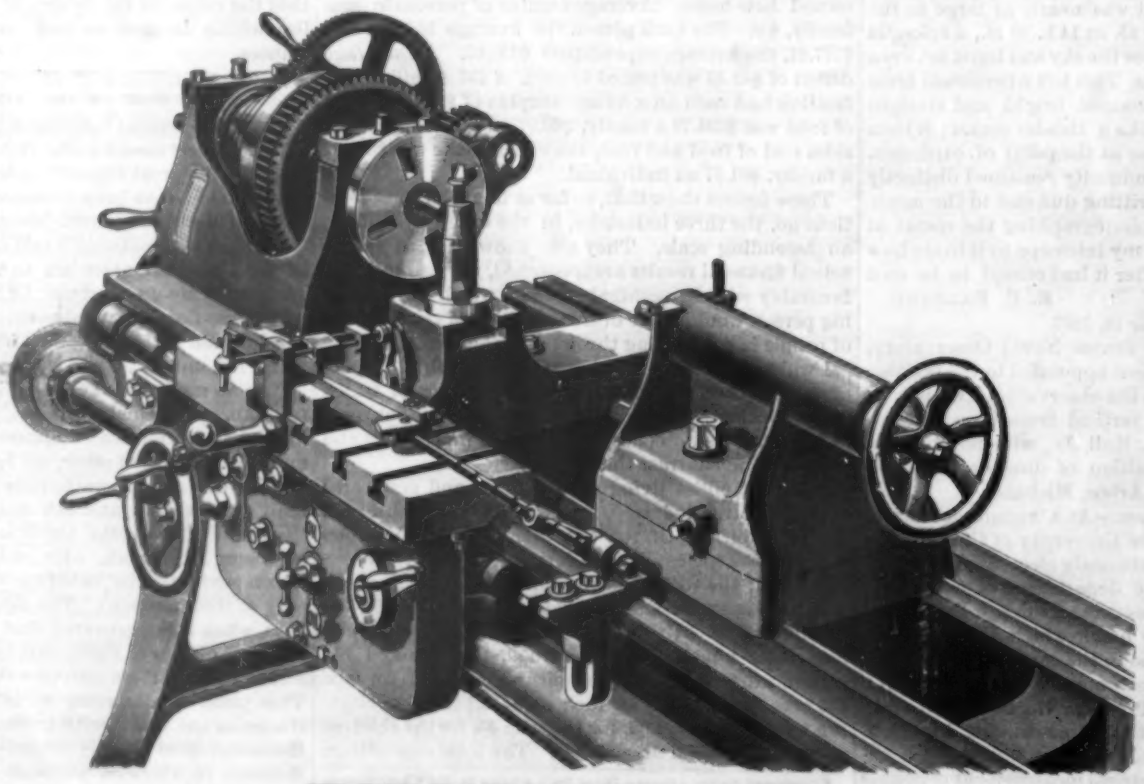
A NEW METHOD OF DISTRIBUTING OIL ON WATER.

Mr. P. Samohod, of Lima, Peru, sends us a sketch of a simple apparatus which he has devised for the distribution of oil from vessels on the surrounding sea surface in stormy weather, and suggests that possibly our government would be willing to give it a trial. The apparatus, as shown in the illustration, comprises a somewhat bow-shaped distributer, near the ends and center of which are globe-shaped, perforated, copper oil receivers connected with each other by metal tubing, and surrounded by sponge, the whole inclosed by a varnished leather cover with many perforations protected by metallic eyelets. The small figures represent the distributer in section and perspective. It has

two metal bands from which chains pass to the deck of the vessel, other chains being connected to facilitate its suspension from the bowsprit. An oil supply hose of good varnished leather or other preferred material extends from a pipe in communication with a pump and reservoir on the vessel to the central one of the three oil receivers, by means of which the oil may be forced into and through the distributer as desired. It is also provided that the oil will pass through a section of coil in a simple form of heater where a lamp may be placed when the weather is cold. It is designed that the length of the distributer shall be equal to about one-third of the maximum width of the vessel. The great efficiency of oil, when used even in small quantities, for the quieting of a pretty large area of the sea around a vessel, and thus materially mitigating the dangers to which vessels are sometimes exposed, has often been fully demonstrated, and its use for such purpose is now becoming quite frequent. The apparatus shown is designed to afford an inexpensive and effective means of so distributing the oil that the vessel will receive the greatest benefit.

AN IMPROVED LATHE ATTACHMENT.

The illustration represents a recently patented appliance adapted for use on any lathe, and readily transferable from one lathe to another. It is attached by taking the nut off of cross feed, so that the tool block can be adjusted by screw in taper attachment, the device being easily operated from any of the four V's on the lathe bed and set at front or back of tool block. It has two sliding jaws to be clamped to the cross slide of the lathe, and operated by a right and left hand screw, so that the attachment will always be in center of tool block. A clamp or strap is furnished to be attached to the tool block, in which a hole is drilled and tapped to receive a binding screw, and when the strap is in position the adjusting nuts on the cross feed screw are set so there will be no end play. The connecting rod is grooved in several places to receive the binding screw in clamp. The taper bar is graduated on one end, so that any desired taper can be easily obtained, and when straight and taper work are to be done on the same piece, the changes can be quickly and easily made. This attachment is furnished by the Prentiss Tool and Supply Company, of No. 115 Liberty Street, New York City.



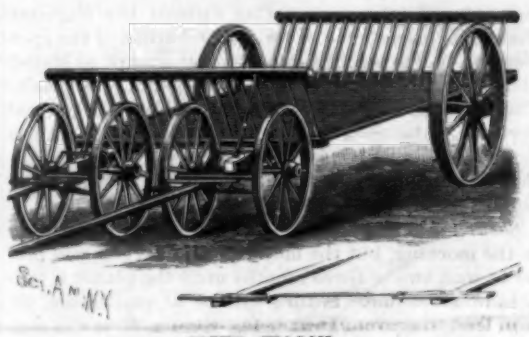
THE HODGE-FRAZIER TAPER TURNING ATTACHMENT.

Gaseous Fuel.

The London *Lancet* publishes the result of an exhaustive inquiry, in which the practicability of employing gaseous fuel for heating and cooking appliances is fully discussed. The article contains a very considerable number of experimental data, upon which the deductions and conclusions contained therein are drawn up. At the outset the opinion is expressed that the universal adoption of gaseous fuel would unquestionably prevent the formation of unhealthy and smoke-laden fogs. With the view of determining whether the gas-producing centers of London would be equal to the increased production of gas necessarily involved, the *Lancet* quotes some facts and statistics of an important character—*e. g.*, taking the Gas Light and Coke Company as a typical source of supply, it is shown that at present their production of gas is equal to twenty thousand million cubic feet per annum, representing some 6,000 tons of coal carbonized per diem; and in order to distribute this enormous volume of gas there are laid down in London streets nearly 2,000 miles of main, exclusive of services and other companies' supply. But the *Lancet* finds a striking and complete answer to the question as to whether the gas companies would be equal to the task of supplying an increased volume of gas were it demanded by its application for heating and cooking purposes in the following remarkable particulars: On Tuesday, December 1, 1891, with the thermometer at 46° F., the consumption of gas was 82,000,000 cubic feet from the Gas Light and Coke Company's works; on Thursday, the 17th, temperature 37°, the demand was 92,000,000. Then suddenly a fog set in, and on Friday, the 18th, temperature 26°, no less than 118,000,000 were required, while on the following Tuesday as much as 128,000,000, that is, some 50,000,000 cubic feet of gas above the normal daily winter demand, and an addition nearly equal to the daily average supply, was consumed. The *Lancet* suggests that if this enormous increase can be successfully grappled with at a single day's notice and maintained for several days (it is often only a few hours' notice, for there are no means of ascertaining the precise moment when fog will appear or when the temperature will suddenly fall), it is probable that even the existing plant, both manufacturing and distributing, is equal to the increasing requirements necessitated by the application of gas for purposes other than those of lighting. The report then discusses the relative heat values of coal and gas, and it is shown that the gas produced from a ton of coal—that is 10,000 cubic feet—is, as regards heat value, broadly one-fifth of the coal from which it is derived, supposing that the total energy of the mineral is utilized; but, as is pointed out, while a large proportion of the heat value of coal is lost in the shape of incomplete products, inflammable gases, soot, etc., gas admits of complete combustion under easy circumstances, and its total heat value is, therefore, utilized. That is, while gas does its duty fully, coal, as commonly consumed, fails largely in this respect. With gaseous fuel there is small possibility of undesirable products being formed, while an important economy as regards heating effect is at the same time secured. The probability of a cheaper gas supply is then discussed. The description of types of stoves follows, and the *Lancet* explains that no sentimental objections on the score of cheerless appearance need obtain on the installation of gas firing, as in by far the majority of cases the stoves at hand are provided with a form of indestructible fuel or coal, which is maintained at a cheerful glow by the heat of the almost invisible atmospheric burner. A very considerable number of experiments with various stoves are then recorded and are embodied in a table occupying two pages of the journal. In dealing with the results comparisons are drawn, defects are pointed out and certain improvements are indicated. The provision of an adequate flue is absolutely essential to the working success of gas stoves; upon this point the *Lancet* is emphatic, as it seems to be a popular idea that because gas fires do not smoke they require no means of carrying off the products of combustion.

AN IMPROVED WAGON.

A wagon having its hauling gear arranged in such a way that a large team of horses may be hitched close to the wagon, which may be easily hauled and the team readily controlled, is shown in the accompanying illustration, and has been patented by Mr. David W. Cotes, of Guthrie Center, Iowa. The wagon has a bed much wider than usual, and with sills projecting forward to be fastened by the ordinary king bolt to short axles, each of which carries a pair of wheels. The axles have forwardly extending tongues, with the customary whiffletrees, whereby four horses may be hitched abreast, the neck yokes of the tongues being coupled together by a detachable rod so that the horses will pull together effectively. When the wagon is used for hauling hay or other bulky material it may be provided with racks at the front and rear, or all around,



COTES' WAGON.

but, without such racks, the wagon presents a broad, firm bed, affording a firm foundation, and adapted to receive scraper loads of dirt or other material.

Difficulties of Identification.

During the progress of a recent murder trial in New York medical witnesses testified it would be impossible to identify the remains of the deceased after burial for three months, without embalming. Also that it was impossible to determine whether poison found in a dead body had been ingested before or after death.

Dr. Herold testified that in one case occurring in his duty as a coroner's physician the body, lying in a police station, was claimed during the evening by three different women, each identifying the dead man by means of a photograph as her husband, and it turned out that neither of them was the wife of the dead man. He had been dead forty-five minutes.

In another case a woman identified her dead husband in a station house, and then went home to find him safe and asleep in bed.

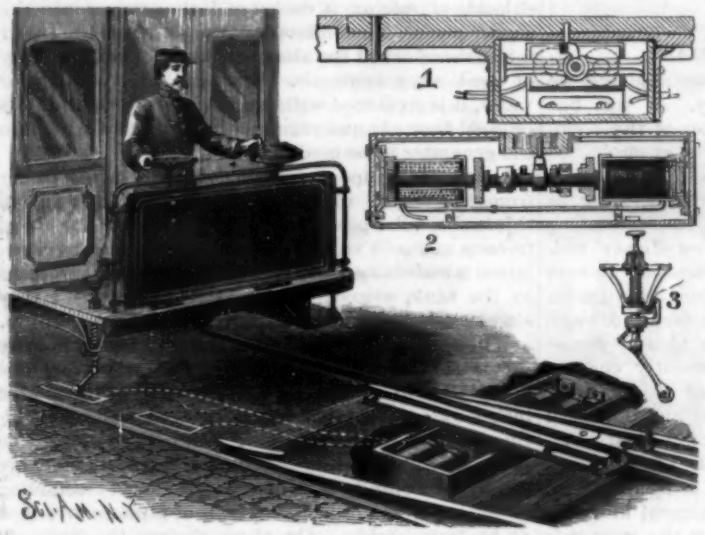
In another case a widow buried the body of her husband; but the real husband turned up alive and well three months later.

The witness said the first putrefaction changes were found in the face within two hours of death.

THE senior class at Yale numbers 185 students; of these 54 wear glasses, the necessity for such aids to vision having, in 25 of the cases, arisen since the students entered the college. The average age of the members of the class is twenty-two.

AN ELECTRICALLY OPERATED SWITCH.

The improvement shown in the illustration is designed principally for application to electric cars, although it admits of being applied to cars propelled by other power. It has been patented by Mr. Henry L. Falco, of No. 643 Carlton Avenue, Brooklyn, N. Y. The view in perspective shows the operation of the improved switch, Fig. 1 being a longitudinal and Fig. 2 a transverse section, while Fig. 3 shows the contact making device. The car may be supplied with the electrical current through a trolley, by storage batteries, or by a small dynamo taking power from the



FALCO'S ELECTRICALLY OPERATED RAILWAY SWITCH.

car axle, the wire carrying such current leading to the contact maker just under the car platform, and carrying at its upper end a foot piece to be pressed upon by the driver or motor man. The contact maker adapts itself to any distance between the car and the contact plates. The switch tongue turns on a pivot, and is mounted in a casting in the usual way. A pin projects from the tongue through a slot in the casting, and enters an arm on a sliding rod in the switch pit, there being on opposite ends of the rod cross bars carrying armatures which enter the coils of electro-magnets. These magnets have short cores and are inclosed in lead to prevent their being acted on by water entering the pit, and the mechanism is inclosed in an iron box with cross bars through which the rod slides, there being on the rod buffers to prevent shock when the armatures are drawn in either direction. There are two insulated contact plates in the roadbed near the track rail, a wire from one plate extending to one of the magnets, while the other plate is connected by a wire with the other magnet. When, therefore, a car approaches the switch, the driver can swing the switch tongue in either direction, to open or close the switch to the main or the side track, by simply pressing on the foot piece to bring the roller on the lower end of the contact maker down upon one of the contact plates in the roadbed, the current then being made to energize one or the other of the magnets to move the sliding rod connected with the switch tongue. The box containing the magnets is closed at the top by serrated covers in the usual way.

Gaseous Theory of the Earth.

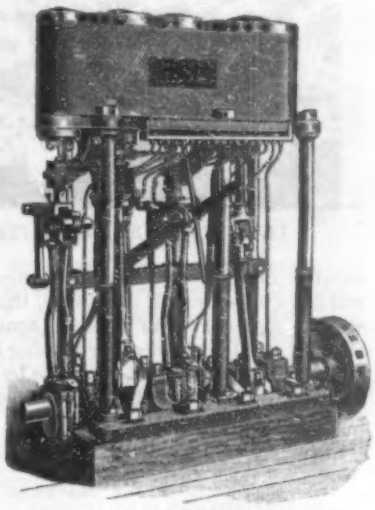
The idea of M. Rateau, as expressed the other day to the French Academy of Sciences, is that the phenomena of the earth's crust are well explained by considering that the planet's interior is molten, and that a layer of gaseous matter separates it from the portion of the crust forming the continents, whereas the seabeds rest directly upon the igneous globe. The continental masses tend generally to rise, being forced up by the accumulating gases, while the sea beds sink. The gradual escape of the gases, imprisoned under high pressure, will in time exceed the production of new supplies, when the pressure will diminish and the continents fall in, giving rise to more or less crateri-form configurations. This is the state in which the moon now appears. Assuming the crust to be 18½ miles thick, the pressure of the gases should be 650 atmospheres, their temperature 900° C., and their density nearly equal to that of water. This theory makes it clear why volcanoes in the interior of continents give off gas instead of lava, and why lines of coast volcanoes have successively receded inland where the sea has encroached.

A FINE YACHT ENGINE.

A fast steam yacht has been recently completed at Bridgeport, Conn., for Mr. H. M. Hills, proprietor of the *Evening Post* of that city. It is 60 feet long, 12 feet beam, and 5 feet deep, drawing 20 inches forward and 3 feet 4 inches aft. The engine for this yacht, shown in our illustration, is a fore and aft compound, designed and built by the Coulter & McKenzie Machine Co., of 500 Water Street, Bridgeport. It is designed to furnish 75 horse power, turning a 3 foot screw 250 turns per minute with 100 pounds of steam, supplied by a Herreshoff water tube boiler. The high pressure cylinder is 6 inches in diameter, the low pressure 12 inches and the stroke 9 inches. The exhaust from the high pressure cylinder passes around that cylinder and into the low pressure valve, thus making a receiver and jacket in one and permitting the passage of steam to the low pressure cylinder without piping.

The pistons are fitted with a sectional Dunbar packing, consisting of a solid center, or "bull" ring, and on each side of which is fitted an L-shaped ring and a square ring. These rings are cut in three or four segments, as may be desired, and are adjusted so as to break joints. The rings are pressed against the walls of the cylinder by means of round wire springs of a diameter equal to the inside diameter of the rings.

The valves are of the balanced piston type, made up of a center and two end pieces held together by the valve stem and fitted with a steam-tight ring on each end. The live steam enters on the top of the valve, passes through the center and enters the cylinder from each end, the exhaust steam passing around the center. All the rods, connections and links have every means of adjustment for taking up wear. The shaft is of steel 3¼ inches in diameter and has bearing surface of 18 inches on the bed. The crank pins are 2¾ inches in diameter by 3 inches long, and are set at an angle of 90 degrees. The shaft is fitted with a Fry wheel, which is also used to balance the two cranks and forms one-half of the coupling connecting the wheel shaft. The cylinders and their heads are neatly incased with German silver covers. On the front and bottom of the cylinders is a reservoir for oil, under which there is fitted a trough holding 18 separate pipes carrying oil to the different bearings, separate oil holes being also provided for each bearing for use in case of need. The propeller shaft is fitted with a patented roller thrust bearing of new design. It consists of a box casting, in which are fitted two bearings, one on each end. Centrally between these bearings is a thrust collar clamped rigidly to the shaft. On each side of this thrust collar is a loose steel collar having four projecting arms or studs on which rollers are loosely mounted. The thrust of the shaft is received by these rollers, which are turned slightly rounding on the face, so as to overcome the sliding motion that would occur if they were flat.



ENGINE OF STEAM YACHT DREAM

One set of these rollers acts when in head motion and the other when in back motion. The box containing this bearing is filled with oil, so that the parts are constantly lubricated and friction is reduced to a minimum.

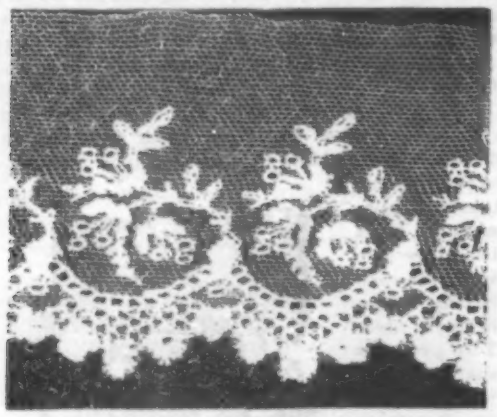
THE "CLIMAX" STEREOTYPER AND MOULDING PRESS.

MAKING CELLULOID STEREOTYPES ETC.

The illustration shows a combination machine embodying recent improvements designed to facilitate stereotyping and moulding, wherein a regulated amount of heat is necessary, and especially for the making of cellutypes, or celluloid plates, to be used in place of electroplates or metal stereotypes. By means of this machine, and the improved methods now followed, it is claimed that celluloid plates are made equal to electrotypes as to sharpness of face, and superior for durability, the plates not being affected by any of the fancy colored inks, and the work being done in far less time than now required. Where one has the necessary steam supply, at a pressure of some sixty pounds, the boiler is not necessary, but where this is not available, as in most small printing offices, the combination machine includes an efficient and specially adapted construction of boiler, whereby the press may be quickly and economically heated, in both its platen and bed, to the required temperature, and then again as rapidly cooled, by the adjustment of valves regulating the circulation of water and steam. The mould is made of a specially prepared powder and gluten water, in which, when it has attained a proper consistency, the type form, engraving, or other representation to be reproduced is impressed in the press, and in this mould an impression is afterward made in a thin sheet of celluloid, the press, mould, and celluloid sheet being heated up to about 240 degrees. The machine is afterward cooled with the celluloid in it under pressure, and the cellutype thus made may be employed in printing as an ordinary electroplate. This process of making plates is well adapted for the representation of

fine lace patterns, etc., the lace itself being placed in the press, and being impressed directly upon the celluloid, a pattern made in this way being shown herewith.

The convenience of such an outfit in a printing office will be at once apparent, as a cellutype can be made in a few minutes of any form from which a large



LACE SHOWN BY CELLUTYPE PLATE.

number of impressions are to be made, or one which will have to be used in the future, thus releasing type and saving time. The machine constitutes the most efficient of all appliances for making rubber stamps.

The "Climax" machine is made by Messrs. J. F. W. Dorman & Co., manufacturers of vulcanizers, stereotype machinery, and all stereotype supplies, No. 217 East German Street, Baltimore, Md.

Trade Marks.

The law of the land respecting the use of trade marks has been summarized and announced to the bar of the Supreme Court of the United States by Justice Jackson. The opinion was read in the case of the appeal of the Columbia Mill Company, of Minnesota, against W. W. Alcorn & Company, from the circuit court for the eastern district of Pennsylvania. The mill company had brought suit to restrain Alcorn & Company from using the word "Columbia" upon a brand of flour sold by the defendant, but the court refused to entertain the proceeding and dismissed the bill. From that judgment the Columbia Company appealed to the Supreme Court. Justice Jackson said that by a long line of decisions in the Supreme Court the law of trade marks was well settled. Those decisions, he said, established the following propositions:

1. That to acquire the right to the exclusive use of a name, device, or symbol as a trade mark it must appear that it was adopted for the purpose of identifying the origin or ownership of the article to which it is attached, or that such trade mark must point distinctively, either by itself or by association, to the origin, manufacture, or ownership of the article on which it is stamped. It must be designed, as its primary object and purpose, to indicate the owner or producer of the commodity and to distinguish it from like articles manufactured by others.

2. That if the device, mark, or symbol was adopted and placed upon the article for the purpose of identifying its class, grade, style, or quality, or for any purpose other than a reference to or indication of its ownership, it cannot be sustained as a valid trade mark.

3. That the exclusive right to the use of the mark or device claimed as a trade mark is founded upon priority of appropriation.

4. Such trade mark cannot consist of words in common use as designating locality, section, or region of country.

In view of these propositions, the justice stated, the court were of the opinion that there was no valid trade mark in the word "Columbia," and the judgment of the court below was, therefore, affirmed.

Remarkable Thunder and Hail Storms.

At a recent meeting of the Royal Meteorological Society, Mr. W. Marriott gave an account of the thunder and hail storms which occurred over England and the south of Scotland on July 8, 1893. Thunder storms were very numerous on that day, and in many instances were accompanied by terrific hail storms and squalls of wind. It was during one of these squalls that a pleasure boat was capsized off Skegness, twenty-nine persons being drowned. About noon a thunder storm, accompanied by heavy hail and a violent squall of wind, passed over Dumfries and along the valley of the Nith; many of the hailstones measured from 1 inch to 1¼ inches in length. At the same hour a similar storm occurred at Peterborough. From about 2 until 10 P. M. there was a succession of thunder storms over the northeast of England and southeast of Scotland, and at many places it was reported that the thunder storms were continuous for nine hours. Two storms were remarkable for the immense hailstones which fell during their prevalence over Harrogate and Richmond in Yorkshire. The hailstones were 4 and 5 inches in circumference, and some as much as 3 inches in diameter. Great damage was done by these storms, all windows and glass facing the direction from which the storm came being broken. It is computed that within a radius of five miles of Harrogate not less than 100,000 panes of glass were broken, the extent of the damage being estimated at about £3,000. The thunder storms in the northern part of the country traveled generally in a north-northwesterly direction, at the rate of about twenty miles an hour. They appear to have taken the path of least resistance, and consequently passed over low ground and along river valleys and the sea coast. Several storms seem to have followed each other along the same track.

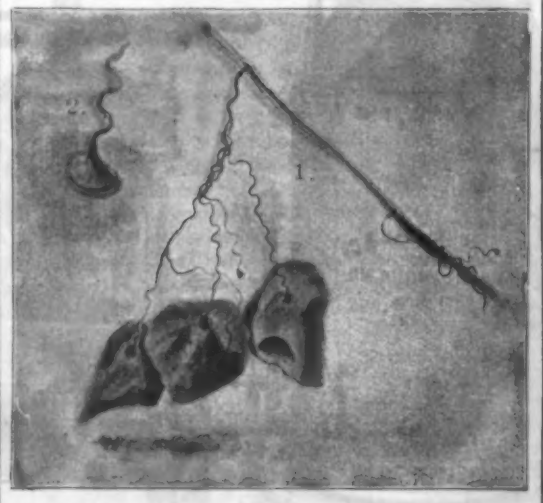
A NEW JERSEY PICK UP PLANT.

For new features in fauna and vegetable life, we are largely indebted to New Jersey. It was but recently that we saw how the daisy crop of the country might, through her instructive example, be doubled. Again has a new lesson come to us from that fertile land, of the handiwork of Nature operating as the handmaid of man.

In the quiet back garden of a New Jersey residence, devoted to the propagation of innocent flowers with savage mosquitoes in juxtaposition, have grown up, to the astonishment of scientists, molecules of vegetation that, by natural attachment to and consequent "swinging to and fro, vehemently encountering other molecules,' have moved stones. Our illustrations will show the mechanical and botanical means by which such results were accomplished. Fig. 1 shows the parent stem, from which are projected cord-like tendrils; our sketch, which is from nature, shows their final attachment to any mineral kingdom in the neighborhood; and Fig. 2 shows the way it is done, which seems, microscopically, to be similar to the way we boys used to take a round piece of boot leg, with a string in the center, and when it had been surreptitiously soaked in the Monday's wash tub, attachment similar to Fig. 2 would permit a good sized stone to be lifted.

Of the sized mineral at present utilized by this new agent of the industries, we are not concerned; it is its future that interests us. Here we have given us by a bountiful nature an embryo power that remains but for the Agricultural Department at Washington to develop to its full capacity. The mind dwells with pictured smile upon the development of those tendrils to rope-like proportions under fostering care. Chemical formulas of potash, nitrates, phosphates, silicas, etc., fed to this infant plant shall bring forth a power useful for man's domination, and not to be sneezed at. Tracts of land in Connecticut, now bountifully sown with bowlders, shall bless her sister New Jersey for this new salvation.

When the department shall have done its duty, a



right-minded citizen of Connecticut may casually sneak out at night and plant a few seeds in his neighbor's hedge, and rightfully find, later on, that this valuable plant has cleared his land. Each of these rope-like tendrils (Fig. 1) has attached itself to a bowlder, and jerked them all off his land on to the next man's lot.

The Frozen Fish Industry at Sandusky, Ohio.

A representative of *The Register* visited the warehouse of the Sandusky Fish Company the other day and there met Mr. Stoll, who showed him the plant and explained the method which he has perfected within the past few months of freezing and preserving both fresh and salt water fish.

The plant consists of two Hendrick Pontifex refrigerating machines, manufactured at Carbondale, Pa., of the absorption principle, their combined capacity being equal to a meltage of 50 tons of ice every 24 hours. If used for the purpose of making ice, these machines would produce twenty-five tons daily. At the present time only one machine is operated, the second being held in reserve. Briefly stated, the principle of the machine is as under:

A large cast iron cylindrical generator is charged with a quantity of aqua ammonia of the specific gravity of 26 degrees. In this cylinder is a coil, heated by steam, which starts the aqua ammonia to boil. The heated gases thus driven from the water are conveyed into condensers where they are cooled off and condensed into liquid anhydrous ammonia. Thence the anhydrous ammonia is conveyed into a chamber called the cooler. Underneath the floor is a cistern with a capacity of 4,000 gallons, containing liquid chloride of calcium. This liquid is sent through the cooler in a system of coils, and the anhydrous ammonia expanding, the chloride of calcium is cooled and then passes into the service pipes. The ammonia gas passes from the cooler into a vessel called the absorber, where there is a spray of weak aqua ammonia. Having a great affinity for water, it is combined with it and resolves itself into its original form of aqua ammonia, which is sent back into the generator to be used again.

A large main pipe containing the cold liquid passes from the engine room into the warehouse, and from this lead smaller pipes which are carried into the sharp freezers and cold storage chambers. A constant circulation is maintained and the chloride of calcium returns to the tank, whence it is used over again with a very slight loss of temperature, in the space of five minutes.

When the fish are unloaded from the boats they are first sorted and graded as to size and quality. These are placed in galvanized iron pans, 22 inches long, 8 inches wide and 2½ inches deep, covered with loosely fitting lids, and each containing about 12 pounds. The pans are then taken to the sharp freezers. These are solidly built vaults with heavy iron doors, resembling strong rooms, and filled with coils of pipes so arranged as to form shelves. On these shelves the pans are placed, and as one feature of the fixtures is economy of space, not an inch is lost. The pans are kept here for twenty-four hours in a temperature at times as low as 16 degrees below zero. Each vault or chamber has a capacity of 2½ tons and there are sixteen of them, giving a total capacity of 40 tons, which is the amount of fish that can be frozen daily if required.

On being taken out of the sharp freezers the pans are sent through a bath of cold water, and when the fish are removed they are frozen in a solid cake. These cakes are then taken to the cold storage warehouse, which is divided into chambers built in two stories, almost the same as the sharp freezers. The cakes of fish, as hard as stone, are packed in tiers and remain in good condition ready for sale. It is possible to preserve them for an indefinite time, but as a rule frozen fish are only kept for a season of from six to eight months. They are frozen in the spring and fall, when there is a surplus of fish, and sold generally in the winter or in the close season, when fresh fish cannot be obtained. The warehouse has a storage capacity of 1,500 tons.

Though the freezing plant has only been in full operation since the first of August, about 550 tons of various kinds of fish have been frozen. Some cisco or lake herring from Canada and some sturgeon were frozen last July and the following varieties were frozen during the fall: No. 1 pickerel, No. 1 blue pike, medium blue pike, yellow saugers, yellow perch, suckers and mullets, sheepheads, white bass, upper lake and Lake Erie white fish, ocean blue fish and weak fish.

It is an interesting sight to note the process of freezing. The interiors of the freezers and cold storage chambers are thickly coated with beautiful snow crystals that give them the appearance of some enchanted cave. The fish, though frozen together, keep their shape; they are very clean and their condition can be seen at a glance. When our reporter visited the place large stacks of sturgeon and other fish were being taken out of the cold storage warehouse for shipment, and they were all in excellent condition. It is expected that there will be a large demand for frozen fish in the next few months, as the fall catch was the smallest on record.

The freezers and cold storage warehouse are of stone, with iron roof and iron doors and concreted attic floor. The place is well ventilated and fireproof, and the entire plant represents an investment of no less than $45,000. Mr. Stoll is to be congratulated upon the successful realization of his plans, which are founded on scientific principles and should be the means of increasing the importance of Sandusky's fish industry and preserving for the use of man the valuable food products of Lake Erie.

A Deep Boring.

The deepest boring of which we have any knowledge up to the present time, says *Revue Scientifique*, is at Parvschowitz, in the district of Ribnik, in Western Silesia. The depth attained is 6,568 ft., and the diameter of the hole is only 2·75 in. The work has been temporarily stopped in order to lower especial thermometers, which have been made with great accuracy, into the hole for the purpose of obtaining the temperature at different depths. The boring will then be resumed, and it is hoped that a depth of 8,200 ft. will be reached.

THE BONTA GLASS ROLLING MACHINE, GLASS GRINDING AND POLISHING MACHINE AND ANNEALING OVEN.

The manufacture of plate glass has hitherto been conducted by a comparatively simple process. The melted glass is poured out upon a rolling table, is rolled out by a roller, and then is immediately transferred to the leer or annealing oven. When the glass is first introduced, the leer is very hot; the temperature is gradually allowed to fall, and after a sufficient time, depending on the thickness of the plate, it is allowed to become perfectly cold. The plate is then withdrawn and ground by mechanical processes on one side. It is then turned over by hand, an operation involving the greatest danger and the cause of numerous breakages. When successfully turned, the other side is ground. For the grinding operations the plate is bedded in plaster of Paris. Owing to irregularities incident to the rolling process and to upheavals or distortions of the floor of the leer, a great quantity of glass has sometimes to be ground away before the even surface is reached.

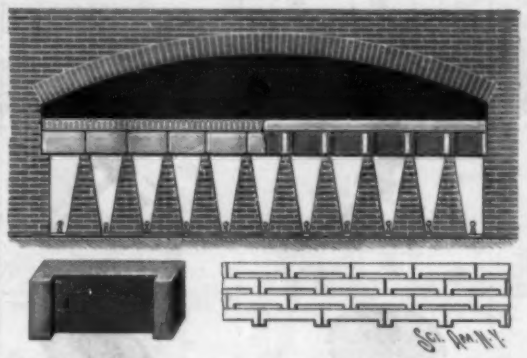
We illustrate an improved glass-rolling machine, one presenting most striking features of novelty and ingenuity, the invention of Mr. J. W. Bonta, of Wayne, Pa. The several cuts give a good idea of the machine, whose operations will now be described.

Its base, built up of plate girders, provides two parallel roller tracks on which the iron and steel bed for supporting the glass while being rolled traverses back and forth. The movement of this bed is effected by power. Over the center of the machine rises a roller housing surmounted by a bridge. On the bridge is established an eight horse power steam engine and boiler for actuating all the parts of the machine. Duplicate beds on which the glass is rolled are provided, flat tables of metal, one of which only is in the traversing position at a time, the second bed being supported in the rear of the machine in an inverted position, some distance above the traversing tracks. In the large cut one of the beds is seen in the front and has just received its charge of melted glass. It is resting on bearers, which in turn rest on the track. Racks gearing into pinions on both sides of the roller are provided, one at each side of the bed. In the rear of the roller housing is seen the second bed, inverted and held at some distance above the track or ways. The bed so raised can be lowered and drawn up again by power applied by the same steam engine. In its rear will be seen a gear wheel. The longitudinal axis of the bed ends at the center of this gear wheel. If the gear wheel were turned, the bed would turn with it.

The description of the operation of the machine will explain its construction further. Taking it in the position shown in the large cut on the front page, the engine, which is kept in continuous motion, is thrown into gear with the roller, set at the desired height according to the thickness of glass to be produced. The roller begins to turn, and the end pinions operating on the racks draw the bed and glass toward the rear of the machine under the roller, thus rolling out the molten mass into a plate. When the rear of the machine is reached, the roller is stopped; the upper bed, which, it will be remembered, is in an inverted position, is lowered on top of the hot glass, and the two beds are clamped together. They are then raised, the glass being held between them, and rotated. This phase of the operation is shown in the small cut on this page. As soon as the horizontal position is reached, the beds are lowered again on the bearers; the upper one, on which the glass was rolled, is lifted, the rollers is tarted in reverse motion and the plate is drawn back again beneath it, so that the glass is rolled upon the other side. Nearly everything about the machine is done by power, one engine actuating the whole mechanism, even to the clamping together of the beds. Throughout the most ingenious details of construction obtain, for whose description we have not space here. This much applies to the rolling of plate glass. The feature of reversing the beds leads to the manufacture of embossed glass of the largest size. Thus, in place of the flat plate on which the glass is first rolled, may be substituted a mould of any desired design and of any size within the limits of the structure. Upon this surface the melted glass is poured and the mould is drawn as described, under the roller, which forces the material, or "metal" as the glass workers call it, into the minutest detail of the design. Reaching the rear of the machine, the plate is clamped between the beds as described; they are raised and reversed, the mould is lifted, leaving the relief plate complete and resting on its back, design upward, ready to be run to the front of the machine, the roller being lifted out of the way, and thence to be transferred to the leer or annealing oven.

To effect these transfers the entire machine, which weighs some seventy tons, is mounted on traversing tracks, by which it can be brought in front of any one of the series of leers. By chains operated by hand windlasses in front of the machine, the plate of glass is drawn into the leer for annealing.

This system of rotating a great sheet of glass is so efficacious that its use in the grinding process was almost a foregone conclusion. Accordingly, another of Mr. Bonta's inventions is for a glass-grinding machine, which is represented in principle by the rear section of his glass-rolling machine. The great sheet of glass taken from the cooled leer is covered with plaster of Paris, and one of the beds of the grinding machine is lowered on it. After setting, it is clamped between the beds and turned over by the machine and its other surface is ground and polished. Plaster of Paris is then poured over it and the second bed is lowered upon it.



General section of oven. Ventilating bricks. Plan view of ventilating brick section.

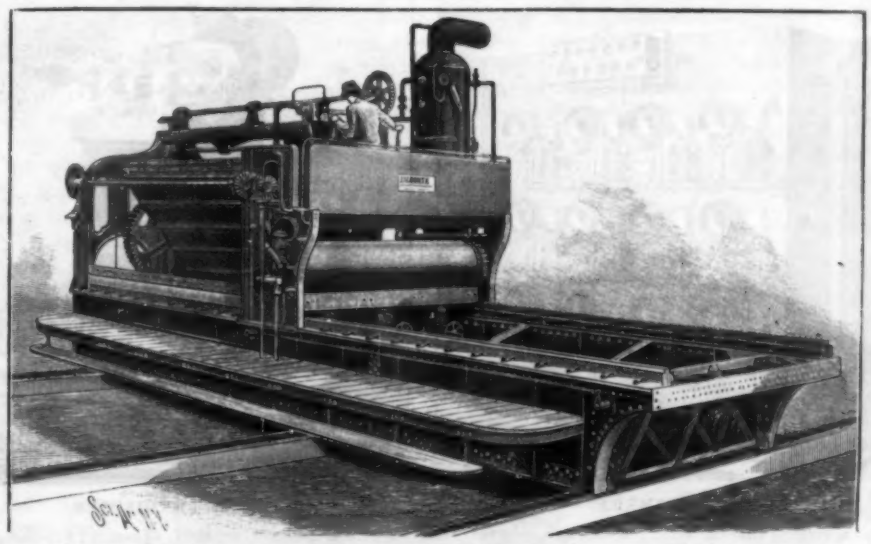
J. W. BONTA'S ANNEALING OVEN FOR PLATE GLASS.

When all is set, the mechanism rotates the two beds with the plate clamped and secured between them, lowers them, and lifts off the upper bed. The plaster of Paris is then removed and the remaining surface of the glass is ground and polished. When it is remembered of what large size glass is now rolled, the immense advance in the grinding apparatus over the old system of turning the great plates by hand will be perceived. Another advantage is incident to this system. The plaster of Paris being deposited on the glass, and not on the bed, forms a more perfect union with the glass, to the exclusion of air bubbles. These air bubbles are bad in their effects, as where they exist the glass yields in the grinding process, and more grinding is required to bring all to a level.

In the leer devised by the same inventor, a system of ventilation beneath the floor is introduced in order to prevent the floor from upheaving. Referring to the sectional cut, immediately beneath the chamber of the leer is seen the floor of fire bricks laid close. Beneath these come a range of fire bricks of the shape shown in the lower left hand figure of the cut, placed vertically. The plan view of these bricks is shown in the lower right hand figure of the cut. These flues open only downward. The substructure is a series of brick piers or foundation walls. At the bases of the spaces between the piers are blast pipes; air being blown through them keeps the foundations cool and prevents any upheaval of the floor.

It is anticipated that by rolling both surfaces of the glass and by annealing it on a leer with perfectly level floor, a saving of very large amount in the glass to be removed by grinding will be effected. By the improved grinding table, the superior embedding in plaster of Paris of the glass, together with the absolutely safe method of reversing, will insure a great saving from loss by breakage. The rolling machine also, it will be seen, opens entirely new possibilities in the rolling of embossed glass. The saving of manual labor throughout will also be very great.

As a test object, a highly artistic mould of "Lincoln's Cabinet at the Reading of the Emancipation Proclamation," from the well known sculptor, E. A. Kretschman of Philadelphia was employed. From it an embossed relief plate of glass, 10 feet long by 8 feet wide, giving the minutest details of the subject, was successfully produced. By making relief panels in opal glass and roughing the surface with the sand blast the effect of Parian marble is attained.



THE BONTA GLASS ROLLING MACHINE—ROTATING THE BEDS AND PLATES.

Coal Consumed in Cities of the United States.

The following report compiled from the mineral industries in the United States shows some interesting comparative figures and the importance of the fuel question. The loss in wasteful handling, and generally acknowledged imperfect combustion that represents millions of dollars, leave a profitable field, for invention, ingenuity and capital combined, to improve upon, if it is considered that only a fractional percentage of gain would figure up to enormous amounts. New York City received for consumption and shipment in the year of 1889, 10,253,706 tons anthracite and 4,353,436 tons of bituminous coal. Philadelphia, 4,751,175 tons anthracite and 2,620,562 tons bituminous. Boston, 1,660,001 tons anthracite and 984,409 tons bituminous coal. Buffalo, 2,480,035 tons anthracite and 1,126,765 tons bituminous coal. Chicago, 1,698,955 tons anthracite and 3,616,876 tons bituminous. The above figures include all coal used by railroad companies and delivered to steam vessels at the points named for their own fuel.

The actual quantities consumed in the various cities, excluding shipments, are as follows: New York City, 3,300,000 tons anthracite and 1,853,436 bituminous short tons; Chicago, 1,444,250 tons anthracite and 3,221,008 tons bituminous; Philadelphia, 3,188,094 tons anthracite and 919,187 tons bituminous; Brooklyn, 1,800,000 tons anthracite and 200,000 tons bituminous; St. Louis, 85,658 tons anthracite and 2,125,391 tons bituminous; Boston, 1,242,001 tons anthracite and 524,409 tons bituminous; Baltimore, 414,928 tons anthracite and 693,685 tons bituminous; San Francisco, 29,800 tons anthracite and 375,012 tons bituminous; Cincinnati, 30,904 tons anthracite and 1,030,948 tons bituminous; Cleveland, 117,157 tons anthracite and 924,602 tons bituminous; Buffalo, 383,653 tons anthracite and 1,032,791 tons bituminous; New Orleans, 12,107 tons anthracite and 435,299 tons bituminous; Pittsburg, 2,294 tons anthracite and 334,035 tons bituminous; Washington, 481,088 tons anthracite and 45,050 tons bituminous; Milwaukee, 402,774 tons anthracite and 262,089 tons bituminous; Scranton, 422,160 tons anthracite and 9,985 tons bituminous; Allegheny City, 1,591 tons anthracite and 100,674 tons bituminous; Reading, 331,944 tons anthracite and 59,902 tons bituminous; Syracuse, 179,891 tons anthracite and 84,327 tons bituminous; Rochester, 280,229 tons anthracite and 119,667 tons bituminous; Jersey City, 334,328 tons anthracite and 132,602 tons bituminous; Newark, 410,918 tons anthracite and 133,158 tons bituminous; St. Paul, 33,675 tons anthracite and 171,367 tons bituminous; Providence, 349,641 tons anthracite and 155,985 tons bituminous; Atlanta, 1,269 tons anthracite and 208,554 tons bituminous; Denver, 10,118 tons anthracite and 300,841 tons bituminous; Paterson, 202 290 tons anthracite and 24,259 tons bituminous; Nashville, 231,300 tons bituminous; Wilmington, 158,614 tons anthracite and 128,515 tons bituminous; Memphis, 45 tons anthracite and 172,669 tons bituminous; Dayton, 4,802 tons anthracite and 178,314 tons bituminous; Louisville, 1,981 tons anthracite and 380,326 tons bituminous; Kansas City, 59,353 tons anthracite and 306,607 tons bituminous; Omaha, 41,279 tons anthracite and 244,357 tons bituminous; Indianapolis, 11,390 tons anthracite and 277,278 tons bituminous; Trenton, 148,554 tons anthracite and 132,840 tons bituminous; Toledo, 98,583 tons anthracite and 153,968 tons bituminous; New Haven, 98,943 tons anthracite and 170,359 tons bituminous.

105 Years Old.

Mrs. Sarah Farley Van Nostrand, probably the oldest person in New Jersey, died at her home in East Millstone on December 15, aged 105 years 3 months and 10 days. Mrs. Van Nostrand retained full possession of her faculties to the very last, and her memory was remarkable.

PHOTOCHRONOGRAPHY IN THE MEDICAL SCIENCES.

In a preceding article we gave a description of a new photochronographic apparatus designed more especially for medical studies. The numerous researches that we have had to make, the many experiments that we have performed, and finally, the financial question, it is very necessary to say, have retarded us. It is for these different reasons that our apparatus, begun nearly three years ago, has been but recently completed. This apparatus is designed to operate in the service of our regretted master, Professor Charcot, at the Salpetriere. We shall describe further along the annex of the laboratory of photography that has been created to utilize it.

In consequence of the special work that we have to do from a medical standpoint, we have had to get up an apparatus entirely different from those used at the present time in photochronography. It is not a question, in fact, of the physician obtaining in a very short time the largest number of photographs possible, but rather, in the study of any phenomenon whatever, of getting a sufficient number of them to seize on the one hand the attitudes that may escape direct observation, and, on the other, to know the general nature of the motion analyzed.

It is necessary, moreover, that the photographs obtained shall have sufficient dimensions and a model complete enough to allow them to be easily studied.

We lay it down as a principle that a number of photographs amounting to twelve is practically sufficient in most cases to seize the different phases of a motion. Consequently our apparatus has been established for giving twelve successive photographs. The problem that we have proposed to ourself, then, consists in distributing these twelve photographs, in a uniform manner, over the duration of the motion observed, whatever be the duration of the latter, from a fraction of a second up to one or more seconds. There is nothing even to prevent operating at more distant intervals, at one or more minutes apart, although at first sight one scarcely feels the necessity of taking photographs at so distant intervals. Yet, from a medical standpoint, in order to observe certain slow-moving phenomena, such as the transfers of contractions or of attitudes during the period of catalepsy, this mode of operation of our apparatus will possess indisputable advantages for noting the position of the patient at accurately determined intervals.

We have consequently had to devise a special arrangement that should permit us to free the shutters one after the other and at variable intervals, according to the velocity of the motion observed. Lastly, it may be useful in the study of certain difficult cases (for seizing, for example, the so movable and varied phases of an attack of hysteria or epilepsy), to take a certain number of photographs in quite a short space of time. Here it will no longer be a question of making a photochronographic analysis of a motion, but rather of noting attitudes that appear unexpectedly and that the physician wishes to preserve.

With an ordinary apparatus one is powerless, since after each exposure it is necessary to remove the frame and to replace it. With ours, on causing each of the shutters to operate isolatedly, it is possible to take a dozen photographs at any intervals whatever and according to the necessities of the experiment.

In both cases the physician has only to maneuver an electric bulb. In the first case, the twelve photographs will be taken in an interval that has been fixed beforehand; in the second, at every contact, we shall obtain a single photograph.

Let us now pass on to a description of our *materiel*, which consists of a camera, or receiver, a transmitter and a distributer.

(1) *The Camera* (Fig. 2).—This is provided with twelve objectives arranged in three parallel rows so as to give the twelve images upon a 9 × 12 plate. Each objective is provided with a shutter of the Londe & Dessoudix system. We have adopted this type of shuutter because it has always given us excellent results in practice and because it is of variable velocity. Here again is one of the characteristics of our apparatus, for it permits, independently of the variability of the intervals between each photograph, it is desired to have objects, the more it is necessary to increase the length of exposure. This still further shows the advantage that will accrue from the possibility of reducing the velocity of the shutters at will.

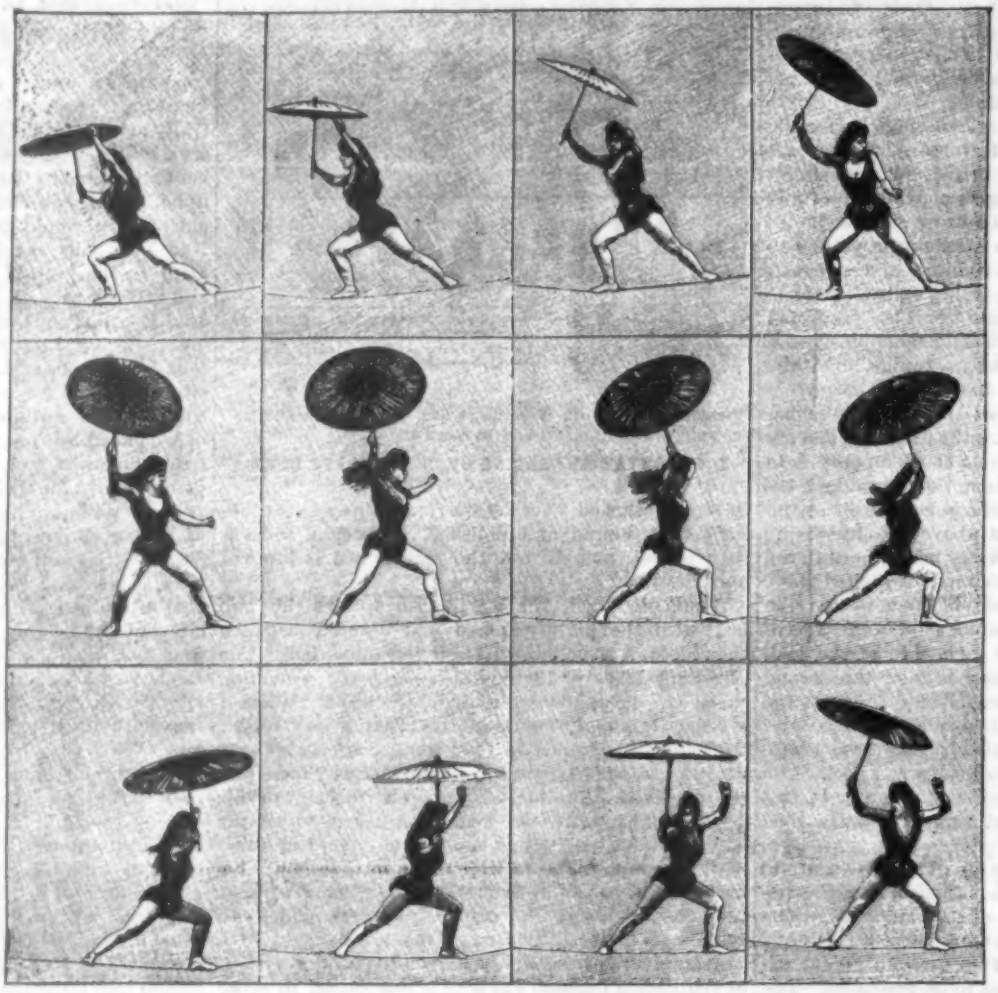


Fig. 1.—FACSIMILE OF A PHOTOGRAPH TAKEN BY MR. LONDE'S PHOTOCHRONOGRAPHIC METHOD.

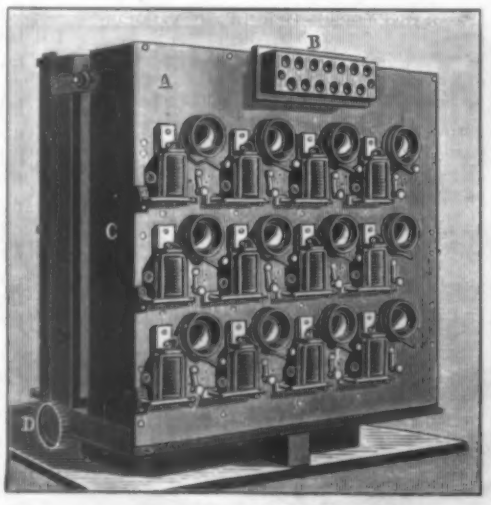


Fig. 2.—CAMERA.

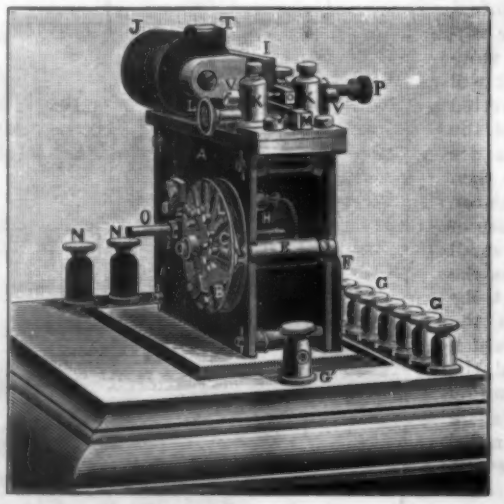


Fig. 3.—DISTRIBUTER.

FIG. 2.—A, covering plate carrying the objectives, shutters and electric gearing; B, thirteen-wire contact; C, camera; D, focusing rack.
FIG. 3.—A, clockwork case; B, brush; C, ivory disk; D, one of the twelve contacts; E, insulating tube; F, the twelve wires connected with the terminals G, G; G^1, return wire; H, escapement; I, armature; J, electro-magnet; L, regulation of the counter spring; N, terminals for the current of the transmitter.

The freeing of the shutters is done electrically. Fig. 2 well shows the electro-magnets and their armatures placed near each objective. The connection of the various wires is effected at a single stroke by means of the piece, B, which is put in communication with the distributer by means of a flexible 13-wire cable, twelve of the wires being in communication with the twelve electro-magnets, and the thirteenth serving as a common return wire.

The apparatus is mounted upon a laboratory stand or a field stand, permitting of transporting it with sufficient facility.

(2) *The Transmitter.*—Granting that the shutters are actuated electrically, it will suffice, in order to assure the operation of the apparatus, to send a current successively into each of the electro-magnets, such emissions of current, moreover, being made at perfectly equal intervals. The realization of such synchronism is a delicate matter. Nevertheless, certain apparatus, such as a well constructed metronome or the Foucault regulator, are capable of giving excellent results, for the reason that the work to be effected, and which will consist in raising a light lever that establishes the desired contacts, could in no wise interfere with the regular operation of these apparatus.

Nevertheless, the metronome can be utilized only for a relatively slow succession of photographs. As for the Foucault regulator, that must be so modified as to give contacts at intervals variable within certain limits.

We have had the good fortune to meet in commerce an apparatus constructed upon such principles by Mr. Trouve and called an interrupter. This instrument, which is designed for medical uses, gives more or less frequent interruptions in a unit of time. By means of a very simple modification, it has been able to serve us for giving emissions of current at intervals regulated in advance.

A metallic cylinder is set in action by means of a clockwork movement provided with a regulator, so as to assure its uniform operation. Upon this cylinder are arranged, in parallel circles, pins whose number increases from one extremity of the cylinder to the other—one for the first, two for the second, and so on up to twenty-five for the last. The object of these pins is to lift a very light lever designed to close the electric circuit. Every time the lever is lifted an emission of the current occurs. The lever and its support are capable of moving parallel with the cylinder, so as to appear before such or such a concentric circle, thus permitting of a determinate number of contacts being easily obtained at will.

As regards our special studies, this apparatus, therefore, constitutes a very practical transmitter. Nevertheless, as the emissions of current always take place in the same direction, it is necessary to employ another apparatus in order to send the current by turns into each of the electro-magnets. This apparatus is the

(3) *Distributer.*—This apparatus, which was constructed according to our directions by Mr. L. Leroy, is represented in Fig. 3. A clockwork movement is inclosed between the pillar plates, A. Upon the last axle is mounted at right angles a rod, carrying at its extremity a platinum brush, B, which is capable of moving over a series of twelve platinum contacts regularly arranged upon an ivory disk, C. Each of these contacts is connected with one of the twelve terminals

represented at G G, these latter being put in communication with the twelve electro-magnets by means of the flexible cable of multiple conductors that we have already spoken of. In the interior, at H, may be seen an escapement wheel, which is controlled by the armature, I, which is attracted every time a current is sent by the transmitter into the bobbin, J. At every attraction, the brush advances by a twelfth of the circumference, and sends the current arriving through the terminal, G', into the corresponding shutter. On taking care, before any operation, to place the brush in the position that corresponds to zero, one will consequently free all the shutters in the order that has been fixed in advance. Such order will depend solely upon the arrangement of the wires of the various electro-magnets in such or such a terminal.

One can thus easily change the order of succession of the photographs according to the direction of the motion, and this is very advantageous for the reading of the results.

The apparatus employs the current of a battery of six bichromate piles, two to actuate the distributer, and four for freeing the shutters.

Operation of the Apparatus.—The focusing having been effected, the shutters are set and their velocity is regulated by means of the lower handle, which moves in five notches corresponding to five different velocities. The Trouve transmitter is so regulated as to have desired number of contacts for the reproduction of the motion that it is desired to photograph. The cylinder is then set in motion, and, after it has been ascertained whether the brush is really in its starting position, the piles are lowered. The operator then holds in his hand an electric bulb, and, when the moment has arrived for operating, he has only to press the latter and maintain a contact during the time of the experiment. The brush of the distributer frees the shutters one after the other, and the photochronographic series is obtained at the intervals that have been fixed in advance. In case it was desired to obtain a discontinuous series, that is to say, the twelve photographs at any intervals whatever, it would suffice to suppress the transmitter. Upon sending the current directly into the distributer, a photograph will be obtained every time the electric bulb is compressed.

In studies concerning locomotion, either in man or animals, a very simple arrangement will permit of making the apparatus operate automatically when the subject arrives in the field of the objectives. Across the path that the subject is to follow is placed a weak thread that keeps separated from each other two metallic plates at which end the conductors that previously led the current into the electric bulb. The current will not be able to pass until, the thread being broken by the passage of the subject, the plates have come close together. The apparatus will operate then at the velocity that has been fixed in advance by the operator, and in this way will be avoided many failures, and will be suppressed the lost time that is inevitable between the moment at which the subject is seen to arrive in the field of the apparatus and that in which the apparatus is set free.

Fig. 4 shows perfectly the arrangement as a whole at the moment at which the operator is about to catch the motion of a subject who is forging a piece of metal. This figure, moreover, represents the new open air laboratory that has just been installed at the Salpetriere, thanks to a subsidy generously granted by the Municipal Council of Paris. A large screen, 20 feet in length by 10 in width, permits the subject to stand out in relief from a plain background. Parallel with the latter there is a horizontal track for the study of motions seen from the side. A second track at right angles with the other permits of catching face or back motions. In the prolongation of this latter track are placed rails that carry the car upon which the apparatus is mounted. In this way, the latter can be displaced with great facility.

The piles, transmitter, and distributer are placed upon a table. The box containing the transmitter is represented open in order to allow the latter to be seen. There is also shown the flexible cable that connects the distributer with the photographic apparatus and the conductor terminating in an electric bulb that the operator holds in his hand. A finder situated above the camera permits of following the subject and of photographing him at the most favorable moment.

This installation will permit us to enter upon studies that it was impossible to pursue with the usual *materiel* and in a laboratory with a glass roof. On another hand, the apparatus is transportable, and this permits us to obtain a certain number of series, either in the country or at the seaside. On the present occasion, just as an example, we give in Fig. 1 a facsimile of one of our negatives representing an equilibrist upon a wire. Mlle. Barenco, of the New Circus, who was kind enough to come and pose for the special benefit of our readers, is, in these photographs, executing a volt from right to left—a motion that she repeats several times in succession, her limbs remaining extended. The series is complete in ten photographs, the eleventh and twelfth representing the beginning of the same motion, but in an opposite direction. The twelve photographs were taken in 1⅛ second. Each of them measures 2¾ by 2¾ inches.

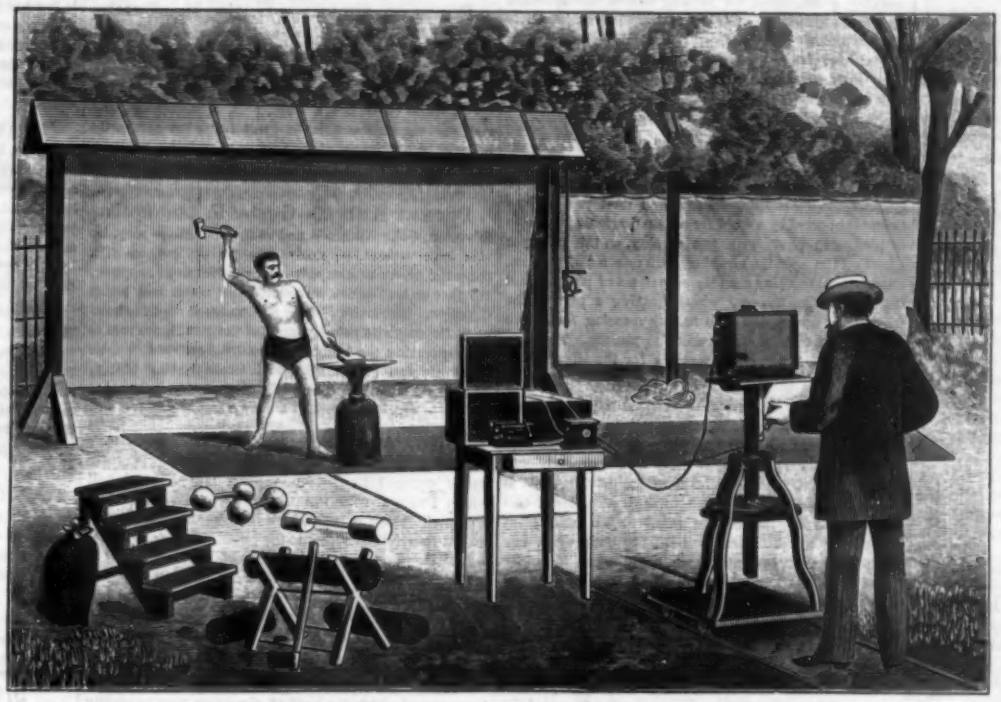


Fig. 4.—NEW OPEN AIR PHOTOCHRONOGRAPHIC LABORATORY.

In conclusion, we believe it our duty to thank all those who have been our true fellow-laborers, and who have been instrumental in causing our ideas to pass from the domain of theory to that of practice: Messrs. Dessoudix and Bazin for the mechanical part, the Messrs. Mors Brothers for the electrical arrangement, and Mr. Lucien Leroy for his distributer. Nor can we forget our venerated master, Mr. Charcot, who has always encouraged our researches in the so interesting field of medical photography, and whom we saw for the last time when he did us the honor to come to witness the operation of the new laboratory installed under our direction in his service of the Salpetriere.—*A. Londe, in La Nature.*

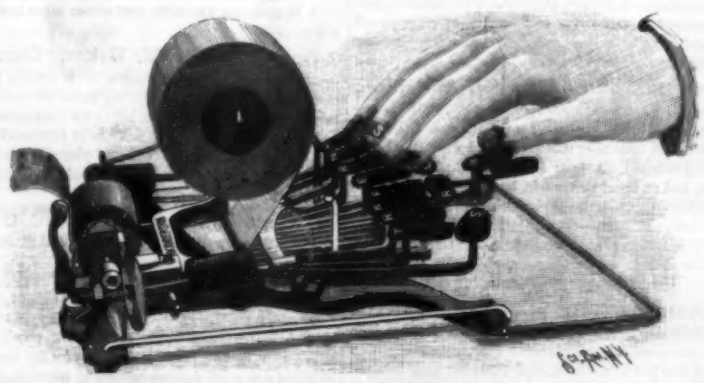
ARTIFICIAL wood suitable for making furniture, roof covering and insulating purposes can be made according to a patent process by burning magnesite together with waste vegetable or animal matter, such as wood, shavings and chips, sawdust, cellulose, cotton, hair or wool. The materials are first pulped with a solution of magnesium chloride in water, or a solution obtained by saturating hydrochloric acid with magnesite, with which mineral the pulp is then mixed and moulded into any desired form. The articles are subsequently lixiviated, preferably in running water. Suitable coloring matter can be added to the materials at will.

Transportation.

The principal lesson suggested by the Fair, as it appears to me, is the importance of improving the means and methods of transportation between the different parts of our country, so that food products of all kinds and perishable goods and materials in general may be carried to market with the greatest possible celerity and in the best possible condition. The great mass of the American people need better food. It is an indispensable basis and condition for their attainment of permanent prosperity and of the fullest civilization of which they are capable. Most of them still think of their food without seriousness and with slight perception of its relations to the highest uses and objects of human life. Though every dish prepared by unwilling hands is poisoned, yet cooking is mostly slave's service, without honor, respect or reward. The life of American working people needs reconstruction, from its basis in the character of their food to its apex, whatever that may be, and one of the most important means for improving the food of the mass of the people is the development of the better methods for the transportation of food products between the different regions of our country. The people who work with their hands for wages, and especially those who work in shops, mills and factories, need more fruit for food, fruit in better condition and at less cost. We should, as fast as possible, reduce the time for railway transit between the great fruit gardens of our Pacific coast region and the homes of the vast populations of our northeastern States. We shall soon have a home market for all our food products; our system of railway management should be such as to secure the best possible markets for producers and the best products for consumers at reasonable prices.—*J. B. Harrison in Chicago Tribune.*

A SHORTHAND TYPEWRITER.

This is a typewriter built especially for rapid work; simple enough to be very strong and small enough to be light, portable and noiseless. In fact, it is not much larger or heavier than a pair of opera glasses. Speed is gained by arranging the keys and type so that every letter on the keyboard can be printed at one time without shifting the hands, all the most frequently used letters being duplicated. Thus in writing the word "start," the "sta" would be struck with the left hand and the "rt" with the right hand simultaneously, the entire word being printed at one stroke, after which the machine automatically draws the paper forward and is ready for the next word to be printed, so that it really requires no more strokes of this kind to print a whole sentence on the Anderson Shorthand Typewriter than it would to merely strike the space key for making spaces between the same words on an ordinary typewriter. This arrangement of the keyboard restricts the number of keys and necessitates the omission of the less frequently used letters of the alphabet. These omitted letters are represented by combinations of those the machine prints, and as soon as this list or code of cipher letters is memorized, the learner has a complete alphabet at his service and can begin practicing for speed. Six weeks' practice will, it is said, give a speed of about 100 words a minute. No knowledge of stenography is required; there is nothing to learn except the list of cipher letters.



ANDERSON'S SHORTHAND TYPEWRITER.

The New York office of the Anderson Shorthand Typewriter is in the World building, rooms 149-151. Among the well known firms employing its operators may be mentioned the Forbes Lithograph Manufacturing Company, of Boston, the *Journal of Commerce and Commercial Bulletin*, of New York, the Trust Company of North America, at Philadelphia, the Kellogg Newspaper Co., Memphis, Tenn., the American Public Health Association, with numerous lawyers, Congressmen and business houses.

Crops of the United States.

The total value of the crops of the United States during 1892 is estimated at $3,000,000,000, of which the largest item is $750,000,000 worth of hay. The animal products, including meats, dairy products, poultry and eggs, and wool, are placed at $965,000,000 more.

RECENTLY PATENTED INVENTIONS.

Railway Appliances.

CAR COUPLING.—Carman Frost, Hewlett's, N. Y. This is a device capable of coupling with a link and pin coupler as well as with another of its kind, and with which the coupling may be effected upon a curved as well as a straight track, there being a simple method of uncoupling, either from a platform or the sides of a car. Combined with a chambered drawbar is a slide having a forward forked end and downwardly projecting branch, there being a spring between the branch of the slide and the end of the chamber of the drawbar. A coupling dog is pivoted in the drawbar and pivotally connected with the slide, while connected with the projection are means for operating the slide.

Mechanical.

MANUFACTURING CHAINS.—Charles White, Barrow-in-Furness, England. This inventor has provided means for making chains with endless links formed from molten metal in a very simple and inexpensive manner. The mould consists of a divided casing or holder with recessed seats, and cores set in the seats having non-intersecting horizontal and vertical recesses registering with the recesses in the seats, the registering recesses of the holder and cores forming elliptical cavities for the reception of the molten metal to form the links of the chain. The recesses of the holder and core sections form non-intersecting elliptical cavities, the planes of which are at right angles to each other.

LUBRICATOR.—Lindley Fawcett, Eureka, Cal. This is a device especially adapted for oiling the bearing surfaces of commutators of electric motors, where only a little oil is necessary, but frequently applied, to prevent grooves being worn in the commutators by the friction of the brushes. The invention provides a swab which wipes the commutators in the same way this would be done by hand, so as to touch every portion of their bearing surfaces, there being a simple arrangement for operating the swabs from the armature shaft, the speed being reduced so that the swabs will be applied at only necessary intervals.

Agricultural.

STALK CUTTER.—James H. Herring, Murphy, Texas. This is a machine adapted to be drawn over a field and cut standing or prostrate corn or cotton stalks, etc., cutting off the stalks at their roots when standing, and reducing them to small pieces which can be plowed under and serve as a fertilizer. The field from which the ears of corn or the cotton have been gathered is thus rapidly cleaned up and strewed with small fragments of vegetable fiber, readily plowed into the soil in condition for quick decomposition and assimilation.

Miscellaneous.

WAVE MOTOR.—James C. Walker, Waco, Texas. This inventor has devised an apparatus to be located in the sea near the shore, for utilizing the power of the waves. In a main supporting frame, properly anchored, a casing supports a vertically movable buoy, adapted to be lifted by a wave, and when the wave recedes the weight of the buoy depresses a pump piston, the rise of the piston and the power developed thereby depending upon the height of the wave and the rise of the buoy, and the power developed by the descent depending on the weight of the buoy and its fall.

VESSEL PROPELLING MECHANISM.—Frank Taff, Whitestone, N. Y. Two elastic blades or fins are, according to this invention, arranged on opposite sides of the vessel, to be actuated by two transverse reciprocating rigidly attached shafts, having a sliding connection with each other at their inner ends, gear wheels and pinions imparting a reversed reciprocating motion to the two shafts and blades. This mechanism may be used of itself alone or as an auxiliary to the usual screw propeller, the fins being designed to operate after the analogy of a fish's tail.

AERIAL CAMERA.—Cornele B. Adams, Augusta, Ga. A camera having an automatic shutter is suspended from a parachute detachably connected to a balloon proper, there being electro-mechanical means for reducing the lifting power of the balloon, and including a barometer in circuit, whereby an automatic exposure will be made when a predetermined height has been reached, and the descent of the camera with the parachute or balloon will then be made.

METHOD OF PHOTOGRAMMETRY.—The same inventor has obtained a further patent providing a method by means of which aerial photographs, taken as above, may be converted into topographical maps, to delineate not only the horizontal positions and distances of objects, but from which the altitude of the objects may be quickly ascertained without the aid of other field instruments. It consists in first taking photographs of the same object or tract from different altitudes, and afterward determining the intersection of the vision lines of the different photographic exposures by geometrical and mathematical processes.

CARROUSEL.—Milton T. Weston, Kenton, Ohio. A merry-go-round that may be readily set up on a lawn, in a hall, or elsewhere, and conveniently taken apart and stored when not in use, has been designed by this inventor, for which he has been awarded two patents. The arms to which the carriages are to be secured are supported on a mast, and the driving mechanism may be operated on to stop the revolution of the arms at any time. Wherever possible the parts are put together with pins or hooks, to facilitate their being readily taken apart and put together. One of the patents especially provides for such construction of the machine that shafts and gearing may be dispensed with, there being a belt connection between the carriage shafts and a grooved drum on the mast. This construction is very simple, durable and inexpensive, besides being very light, reducing the friction to a minimum.

WORKMAN'S TIME RECORDER.—George W. McAninch, Davenport, Iowa. In a suitable casing are oscillating rollers driven by clockwork, the rollers carrying a detachable ruled time sheet, and there being on the front of the casing hooks on which the workmen place checks in going to work, removing them on leaving. Both the placing and removing of the checks cause punctures to be made in the sheet in such manner that, at the end of the week, it will exhibit a complete record of the workman's time. The machine is not liable to get out of order, automatically adjusting itself daily, and being reset once a week.

BICYCLE.—George B. Robinson and William R. Roby, Colorado Springs, Col. This invention relates especially to the driving gear of safety bicycles, affording a convenient differential gear mechanism by which the speed and power may be changed at will without dismounting. The construction is simple and substantial, and also provides a positive and easily working arrangement for turning one of the sprocket wheels on the pedal shaft faster than the shaft itself. By the simple movement of a lever the gear may be shifted to or from either one of three positions, the first being the normal position, the second one in which the gear works slower and with greater power, and the third position giving greatly increased speed.

SPEED GEARING FOR CYCLES.—George Glydon, Birmingham, England. This is an improved gearing which is also adapted for use on other machines, being simple, durable and dust proof. In a casing supported by a fixed frame are journaled two sets of pinions in mesh with one another, an internal gear wheel on the spindle meshing with one set of pinions, a spur wheel meshing with the second set of pinions, and a hub carrying the spur wheel forming a part of the wheel to be driven, the hub having a casing forming a cover for the casings supporting the pinions. The several casings also form a receptacle for the oil or other lubricant.

BICYCLE.—Murray Acklin, Angel Island, Cal. This improvement relates especially to the driving gear of bicycles, providing therefor a speed shifting apparatus which is simple, durable and extremely convenient. On the middle portion of the driving shaft is a clutch mechanism adapted to engage either of two sprocket wheels, the bicycle being driven with great power, for up-hill work or hard traveling, when one wheel is engaged, and at a high speed when the other wheel is engaged. The engagement with one or the other of the sprocket wheels is effected by the movement of a lever, and when this lever is placed in position so that neither of the sprocket wheels is engaged, the machine is adapted for coasting.

GRAIN CLEANING MACHINE.—Sylvester Bisbee, Madelia, Minn. This machine is especially adapted for the effective treatment of flax, as well as the cleaning of other grain. Groups of screens are employed in the machine, to which constant motion is given, the good grain falling through the meshes of the upper to the lower screens of each of the groups, and passing out of the rear of the machine into a blower, where it is cleared from all foreign matter. Brushes work against the screens constantly to thoroughly clean their meshes and promote their efficiency, rendering them capable of delivering material more quickly and in better condition than where such devices are not employed.

DISTILLING AND CONCENTRATING APPARATUS.—Albert F. Trageser, New York City. This is a simple and inexpensive apparatus for the treatment of glycerine and heavy oils, requiring no separate vacuum pan, whereby it may be employed by small manufacturing establishments, permitting soap makers to make glycerine from their own soap lyes. The improvement comprises a shell provided with an evaporator, a receiver and a condenser located one above the other, the condenser being connected with the still and discharging the condensed vapors into the receiver, which serves as a storage reservoir for the accumulating liquid, and is adapted to charge the evaporator.

DECOMPOSING FUSED METALLIC CHLORIDES.—Farnham M. Lyte, 60 Finborough Road, London, S. W., England. This is an electrolytical process for the decomposition of the chlorides severally or in admixture while in a state of fusion, and consists essentially in effecting the decomposition within an open-mouthed, bell-like chamber, sealed by dipping into molten metal corresponding to the base of the chloride under treatment, and resulting for the most part from the decomposition of the chloride. This method prevents the escape of chlorine and permits of running off the metal as fast as it is reduced, besides presenting other highly valuable features.

AXLE BEARING.—Henry N. Hamilton, Yonkers, N. Y. The axle is, according to this improvement, provided with a number of collars, and the hub has a box with internally screw-threaded ends, the outer end being reduced. A tube leads from the box through the hub, and an apertured skein having its ends externally screw-threaded, the inner end being enlarged and having internal shoulders to fit upon the collars of the axle. The bearing is cheap and practically self-oiling, being adapted to run a long time and keep the axle spindle well oiled, while also excluding dust.

COMBINATION LOCK.—John A. Bexell and Victor O. Peterson, Rock Island, Ill. This is a simple, compact, and inexpensive lock, consisting of a cylinder inserted in the door, and provided with internal grooves parallel and at right angles to its axis, an enlarged knob spindle carrying spring-pressed followers adapted to work in the grooves of the cylinder, a key being made to act on the followers to force them to unlocking position. The bolt is operated by a lug on the hub of the knob spindle, while a spring-pressed latch pivoted to the bolt engages the bolt-operating lug.

EASEL.—Charles E. Fountain, Port Townsend, Washington. Opposite standards have at their upper ends notched posts between which a drawing board is held to swing, with fastening devices to support the board at any desired height, and means for fixing its inclination. It is also provided with swinging tables adapted to hold water, paint brushes, etc., arranged on opposite ends of the easel, these tables being fastened beneath the drawing board when the easel is to be packed away, it then taking up but small space.

KEY RING.—James M. Matthews, Graham, Va. This device consists of two open links, one split longitudinally to form a passageway for the other, and each of the links having at both ends inwardly extending arms, a pivot connecting two corresponding arms. It requires considerable skill to open and close the links to insert or remove a key, thus preventing their accidental displacement or removal by unauthorized persons.

FIREPLACE DAMPER.—Erick J. Johnson, Chicago, Ill. This is an improvement on a former patented invention of the same inventor, and provides for a cam adapted to engage the pivoted damper plate, to swing it up or down in the throat of the fireplace and to lock it in position. The damper is thus automatically supported in position, and the construction is simple and durable.

FOLDING CHAIR.—Gutie H. Tuttle, Shorter's Depot, Ala. This improvement is especially applicable to dental chairs, the construction being very strong and inexpensive, and the chair, when not in use, being foldable in such manner as to occupy but little space. The chair has a back, seat, seat support, and foot rest, the back and the foot rest being independently adjustable, so that the chair may be placed in a position to suit the patient, or to place the patient in the best position to be operated upon.

POCKET KNIFE.—Gustaf F. Lundquist, Silverton, Col. All kinds and shapes of knives may, by this improvement, be made to serve the purpose of a magnetic needle or compass, so that one can at any time, whether on land or sea, determine the north and south direction. The knife ends or terminals are made to have opposite magnetic polarity, and on the handle are means for supporting the knife horizontally, but free to rotate. The knife can also be made to indicate the time of day, by use as a sun dial. The application of this interesting feature to a knife is made at a very slight expense.

JAR CLOSURE.—Frank. H. Palmer, Brooklyn, N. Y. The neck of the jar has an annular flange engaged by the ends of a spring wire bail which extends over the top of the cover, the bail holding in place a ball which closes an opening centrally through the cover into the jar. After the cover is locked in place and the contents of the jar steamed, a partial vacuum is formed, whereby the jar is tightly sealed. To remove the cover, the bail is sprung off, when it is easy to remove the ball valve, thus breaking the seal and loosening the cover.

SPOON.—William J. Osterman, Richmond, Va. This spoon has an attached scraping device by means of which the bowl of the spoon may be readily cleaned of any sticky material. The scraper has its lower edge conformed to the curvature of the bowl, and has a shank sliding in guides on the handle, and giving a spring pressure whereby the scraper will press the spoon throughout its stroke, and will be held in any position it may be set along the bowl.

ATTACHING ELASTIC BANDS TO BOXES.—José Pou, Havana, Cuba. To quickly attach bands or other springs to match boxes, etc., for holding the cover in place, a machine has been devised by this inventor. A reciprocating needle is adapted to pass through the cover and bottom of the box, to form openings, and having a hook for supporting an elastic band and drawing it through the openings, in connection with wire-feeding devices to feed a wire on each side of the box through the elastic band.

WASHING MACHINE.—Peter M. Thompson, Anaconda, Montana. This machine has a semi-circular body in whose bottom rubbing rollers are semi-circularly arranged, the rollers being polygonal in cross section. A rubber provided with a series of ribs is adapted to be rocked or laterally reciprocated to rub the clothes placed between its ribbed surface and the bed of the rollers, in such manner that the position of the clothes will be constantly shifted, successfully removing the dirt without liability of injuring the clothes.

STEAM COOKER.—John A. Kendall, Maysville, Mo. This cooker is designed to facilitate the preparing of food without the loss of nutriment or flavor by evaporation, and prevent the odors of cooking from being distributed through the house, the steam being retained and condensed in the apparatus. A cooking vessel is fitted to a water-heating vessel, and has a cover extending down into the latter, while combined therewith is a steam chamber and one or more food receptacles.

BOX.—Joseph M. Baker, Louisville, Ky. This improvement relates to a former patented invention of the same inventor for boxes for holding plug tobacco, etc., forced into the box with considerable pressure. The box requires no nails, is of increased strength and admits of the use of thin end pieces, while it can be quickly and readily opened and remain the neat-looking package it was before opening.

TRUNK.—James L. Warren, Goshen, Texas. This trunk has a deep lid hinged at one side as usual, a tray jointed to the same side as the lid by bent hinges and folding against the top of the lid within, while a lower tray is hinged to the rear side of the trunk body and folds up against the other tray, there being hinged lids for both trays. The trunk provides novel adjunctive features better adapting it for the reception of clothing and small articles needed by travelers, and their convenient stowage and removal.

WINDING KEY FOR GUITARS.—John Ayuso, Brooklyn, N. Y. This is a supplementary key adapted for use in connection with screw keys, whereby the latter may be more quickly and conveniently turned than with the fingers. Instead of the half turn only, at one effort, the screw can, with this improvement, be given a complete turn with each twist.

SLED.—Franklin N. Wilde and Elmer F. Campbell, L'Anse, Mich. This improvement relates especially to lumber or bob sleighs, for which purpose the inventors have designed a simple, inexpensive, and very strong sleigh, made entirely of metal, preferably steel, with the parts so formed that they may be conveniently put together. The runners have flat bottoms and upturned side flanges to which are secured shoes, bearing blocks to which is secured a cross beam supported on the runners, knee braces being fastened to the beam and to the runners, and a bolster pivoted on the beam.

REFRIGERATOR.—Anton Larsen, New York City. This is an improvement in refrigerators having a siphon attachment for drawing off the water accumulated in the drip pan by melting ice. A trap is employed to prevent the escape of cold air from the box with the discharge water, the water siphoning out only when it has reached a certain height, and the water at all times constituting a seal against the escape of cold air.

VEGETABLE CUTTER.—Constantin Raible, Oskaloosa, Iowa. This is an improvement on a former patented invention of the same inventor, providing a cutter to cut or slice vegetables to any desired thickness. It has a cutting cylinder with its periphery formed of alternately arranged knives and hinged throat plates, there being adjustable stops for limiting the inward movement of the throat plates, which are adjustable relative to the edge of the knives to regulate the thickness of the slices.

BOOMERANG.—Charles W. Renear, Stockton, Cal. This is a toy embodying the principle of the Australian boomerang, but adapted to be thrown by a gun or other suitable instrument instead of by hand. It has flat arms extending at an angle to each other and twisted slightly, with a safety edge flange extending around the edges and terminating near the elbow. It has an erratic path when projected, but is extremely light, so that it may be harmless.

MEASURING TOOTH ROOTS.—Asher I. F. Buxbaum, Cincinnati, Ohio. The device designed by this inventor for the purpose named forms a wire loop for measuring the circumference of teeth or their roots, and consists of a tube or hollow body, and a portion through which the wire passes, and which is rotatable on the body to twist the wire to form the loop. The device is very efficient and measurements are thus quickly effected.

DESIGN FOR A SKATE.—Sylvenus D. Mosher, Storm King, N. Y. The blade of this skate is relatively long, its bed has concave sides, and on the bed are raised heel and ball surfaces of oval shape, with open panel-like figures.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

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Minerals sent for examination should be distinctly marked or labeled.

(5624) G. A. M. asks (1) for a compound with which to coat wood and metals so that they will resist the action of the acids such as are used in batteries. A. Paraffine wax or thin sheet gutta percha. 2. Would it be practical to make a Gramme ring motor as few as four coils, and would it have any advantages over one with a Siemens armature? A. You can do this; but it is not advisable, and would not be better than a Siemens drum armature. 3. Is there any salt of mercury which can be put into the battery solution to keep the zincs amalgamated? A. Mercury nitrate. 4. Is there any simple way of finding the number of revolutions of a small motor or engine? A. Attach a sharp-pointed pencil near the axis of rotation. Move a piece of paper mounted on a board in front of the pencil. Keep it moving steadily for five or ten seconds. Then count the turns in the spiral. Some one may time you while you move the board.

(5625) E. R. W. asks: 1. Please tell me exactly how the resistance of commercial German silver wire compares with that of pure copper. A. German silver varies in resistance according to its composition. If you use the factor 12 or 13, you will not go far wrong. 2. What is the rule to find the number of ampere turns required to get a given lifting power from a given magnet core, allowing for distance of the coils from core? A. There is no general rule. It all depends on the shape, material, and dimensions of the magnet core. The calculations must take leakage of lines of force into account. We refer you to Sloane's "Arithmetic of Electricity," $1; Thompson's "Electro-magnet," $1; Thompson's "Electro-magnetic Machinery," $5. These we can supply by mail. 3. If I have a storage battery with ten 6½ × 4½ inch plates, each plate punched full of ¼ inch holes, which are filled with red lead, how fast can I discharge it without injury; that is, how many amperes can I pass through it. About how many ampere hours would it have? A. Allow six amperes per square foot of positive plate; about six amperes for the battery. It should have sixty ampere hours. 4. What would be its internal resistance, the plates being separated about three-sixteenths inch? A. Almost negligible; perhaps one one-hundredth ohm. 5. In "Experimental Science," page 307, it says: "The Weston dynamo is also perfectly adapted to incandescent lighting. With a constant speed the regulation of the current is automatic." Just before this it describes the way in which shunt-wound dynamos regulate themselves in arc lighting where the lamps are connected up in series. Now, in arc lighting, as I understand it, as the resistance is lowered by turning out some lamps, the voltage falls; and in incandescent lighting, when the resistance is lowered by turning on some lamps, the voltage remains the same and the amperage increases. Why does in the one case the voltage change and the amperage remain the same as the resistance of the external circuit falls? And in the other does the amperage change and the voltage remain the same, the resistance of the field magnets being the same, since the dynamo in both cases is self-regulating, according to "Experimental Science"? A. Supplying lamps in parallel, a shunt-wound dynamo will regulate itself tolerably well, if the armature resistance is low. It is especially adapted for series lighting. It is more sensitive to irregularities of speed than is a series-wound dynamo. The action of shunt-wound dynamos is best studied from their characteristic curves. Examples are given in Thompson's "Dynamo-Electric Machinery." 6. If a dynamo had its field magnets always of the same strength (being excited from some different source), and was run at a perfectly uniform speed, would a change of the resistance of the external circuit change the voltage? A. The voltage would be constant. 7. Suppose we charge a storage battery thus: The whole resistance of circuit is 15 ohms. At its end is a storage cell with terminals M and H. By Ohm's law ($\frac{1}{15} = \frac{1}{15}$) ¼ ampere would pass; but since C R = E. M. F., the potential between M and H is ¼ volt ($\frac{1}{4} \cdot 2 = \frac{1}{2}$); but ½ of a volt is not enough to overcome the voltage of the storage cell. Hence it would not charge. Please show me where the mistake is in the above conclusion. There must be one somewhere. A. In treating an electric circuit with opposed voltages, you subtract the less voltage from the greater and take the remainder as the net or actual voltage. The rule you cite applies only to actual resistance of a circuit through which a current is passing. Counter-electromotive force cannot be treated as if it were resistance.

(5626) J. P. G. writes: 1. In SUPPLEMENT, No. 641, on page 10240, in second column, you give No. 18 wire for armature, and on next page, last column, No. 16 for same. Which size is proper? A. It should read "No. 18" for armature coils. 2. Is wire to be single or double wound? A. Single wound is more compact. You may use either. 3. Could motor be connected to some power and give satisfaction, same as run with battery power? A. Yes; as a motor. It is not adapted for use as a dynamo. 4. How many revolutions is the armature required to make? A. As a motor, this regulates itself by the power, say 1,000 to 2,000 per minute. 5. How many 16 candle power incandescent lamps would the above motor run? A. None.

(5627) C. S. asks how to make a dry cell. A. See our SUPPLEMENT, Nos. 157 and 767; also the SCIENTIFIC AMERICAN, vol. 61, No. 20, and vol. 67, No. 2.

(5628) E. F. asks: 1. What must be the essential difference between an arc lamp designed to burn on a constant potential circuit and one designed to burn on a constant current circuit? A. The constant potential lamp must have a resistance coil in series to steady it. The constant current lamp must have an automatic cut-out, so that if one lamp goes out it will not open the circuit. 2. With what is aluminum combined in its natural state, and how may I obtain some of the ore? A. With oxygen generally, in all clays, and earthy minerals in general; with fluorine in cryolite. 3. Has ammoniacal alum ever been obtained by the direct combination of ammonia, sulphuric acid, and aluminum? A. No; except possibly as a chemical experiment. 4. If it has, please tell how. If not, would the combination be of any value? A. Dissolve the aluminum in hydrochloric acid; evaporate with sulphuric acid until all hydrochloric acid is expelled; add requisite amount of acid, if necessary, and of ammonia, and crystallize. There would be no object in carrying out such a process.

(5629) W. S. D. writes: The recent application of electricity to canal boats is regarded as a great invention. Now, it has always been stated that steam could never be used as a motive power on canals for the reason that the banks were undermined and ruined by the wash of the swiftly moving boat. Could you, through your paper, kindly explain to me and several others why the wash of an electric canal boat, moving at the rate of eight miles an hour, would be any less ruinous to the banks of the canal than the wash of a steam canal boat moving at the same rate of speed? Both boats, of course, to have screw propellers. A. The mode of propulsion does not affect the wash on the banks of a canal. Stern and bow wheel propulsion was tried on the Erie Canal as early as 1833, and was then declared inadmissible on account of the wash. The Baxter system of screw propulsion began about 1870, in which speed was sacrificed to save the banks, four miles per hour being about the average, while six to seven miles could be made by the same boats between New York and Albany. B. T. Babbitt built an experimental boat to overcome the difficulty by jet propulsion, taking in the water at the bow and discharging at the stern. It did not meet expectations, and the scheme was abandoned. No matter what kind of power is used, the speed of the boats, if made for carrying the greatest bulk, must conform to the hydraulic condition of the canal. Depth and width are the all-important exponents of speedy transit on our internal waters. We have seen the light draught, sharp-lined packets of the olden time drawn at the speed of a full trot with nine horses, or at seven miles per hour, with the waves curling over the tow path, but destructive to the canal. If ever an average speed of eight miles is accomplished on our canals on a commercial basis of profit, it will be when the canals are 10 feet deep and 150 feet wide.

(5630) W. J. R. asks: How is it that stumps of trees are found in the bogs of Ireland as far as twenty feet from the surface, which look as if they had been broken off? I have never found any one that could give me any explanation as to how they came to be so situated. A. The tree stumps found beneath the surface of bogs and swamps grew there in prehistoric times, before the water was raised above their roots. Geological changes in the level of the land have caused the water to rise or the land to settle and cover the lower part of the trees. The part above the water decaying, left the stumps under water, which preserved them until the vegetable growth converted the pond or swamp into a peat bog. There are many such examples in Europe and America. Sound cedar timber is now mined from ten to twenty feet below the surface in the swamps of Southern New Jersey.

(5631) R. W. C. asks for a formula for computing the number of pounds pressure a boiler will stand, if you know the thickness of the iron and the size of the boiler. A. The bursting strength of a boiler is the thickness of the iron or steel in decimals of an inch, multiplied by its tensile strength, minus the per cent of loss of strength by the method of riveting. The product divided by one-half the internal diameter of the boiler. A single-riveted shell, with the best proportion of size and pitch of rivets, may be rated at 60 per cent of the value of the plate; a double-riveted shell at 70 per cent. For example, a double-riveted boiler, 48 inches diameter, five-sixteenths inch steel plate of assumed 60,000 pounds tensile strength, the figures will be $\frac{0{\cdot}31 \times 60{,}000 \times 0{\cdot}70}{24''} =$ 542 pounds, the ultimate strength of the boiler. The safe working pressure should be one-sixth, or 90 pounds.

(5632) C. W.—Catgut is made by scraping the entrails of sheep, twisting them while stretched, and holding them so until they are dry.

(5633) J. R. asks: 1. A test suitable to make before an audience to demonstrate the existence of opium in cigarettes. A. Try treatment with boiling alcohol and application of the ferric chloride test to the filtrate. This gives a dark blue color. 2. Is it probable that there would be enough arsenic to detect by Marsh's apparatus? A. It is doubtful. You can easily try it. Use chemically pure zinc and acid in making the test. 3. Is it injurious to health to sleep in a room with a coal fire burning in an open front stove? A. Not if the stove has a proper draught. 4. Is it true that the top portion of a buggy wheel turns faster than the lower portion? If so, why does it? A. See our SUPPLEMENT, No. 706.

(5634) W. C. asks: 1. What determines which is the positive pole in a thermo-electric pair? A. The relations are determined by trial. There is no universal rule, and the thermo-electric relations of metals are different at different temperatures. 2. What two metals give the greatest current? A. Bismuth and crystallized antimony at ordinary temperatures. 3. Does the E. M. F. depend upon the number of pairs in series, or upon the intensity of the heat applied? A. On both. 4. Is there any varnish not affected by boiling water? A. We can give no reliable formula.

(5635) D. W. R. writes: We have a dynamo (5 K. W.), 105 volts. Could I connect it so that I could weld iron or "burn" sheet lead? If so, how shall I proceed, or where can I obtain information regarding it? A. Your dynamo is of far too high resistance for incandescent welding. The usual way of operation is to employ an alternating current dynamo and to convert the current into one of higher intensity. We refer you for full information to our SUPPLEMENT, Nos. 801, 802, 763, 682, 785, 778, which we can supply at 10 cents each by mail. Our SUPPLEMENT, No. 840, describes the Bernardos system of using the arc. This would operate with your machine.

(5636) G. A. G. asks: 1. Can I draw electricity from a storage battery and use it for heating in welding and smelting iron and minerals, and how shall I proceed? A. A storage battery may be used for welding, but is not to be recommended. A proper dynamo, with converter if necessary, is better. It can be used for smelting by using electric light carbons for terminals leading into a mixture of the ore with coke dust; but it will be expensive. 2. Is the storage battery patented, and where offered for sale? A. There are patents affecting different features. Address Queen & Co., whose address you will find in our advertising columns. 3. What kind of dynamo shall I use for storing this electricity? A. Use a dynamo giving two and one-half volts potential for each cell that is to be stored. Charge at the rate specified by the manufacturer of the battery.

(5637) C. H. McD. writes: 1. I have four storage batteries running a 4 candle power lamp of 6 volts. At times the lamp grows dim and then brightens up again; what is the cause of the batteries acting so? A. It is impossible for us to tell where the trouble is. If the battery is a good one, it should give ample current. 2. Can you give me approximate amperage of these cells, each cell having four plates, 6 × 8, covered with red lead paste? A. About four amperes, if the cells are in good condition. We imagine they are not, from your trouble with the lamp. Perhaps they are not fully formed. 3. I have a No. 3 Knapp motor, taking from four to ten volts. What is required to change motor into a dynamo? A. No change is necessary, if the field magnet core is of cast iron. But a small motor is apt not to give much return as a dynamo.

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December 19, 1893,

AND EACH BEARING THAT DATE.

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